Does Low Leverage Minimise the Impact of Financial Shocks? New Optimisation Strategies Using *Islamic* Stock Screening for European Portfolios

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Abstract

This study embodies a preliminary endeavour at analysing the impact of leverage on portfolio behaviour, with specific reference to return and volatility, in the European stock markets, using the debt ratio as one of the important benchmarks for Islamic stock screening. Given the focus of Islamic stock screening on the debt ratio, we use data from 320 firms for eight European countries which were classified according to their level of debt and size. For this, the portfolio optimisation based Mean-Variance Efficient Frontier (MVEF), the Sharpe Ratio and the Capital Market Line (CML) were employed. Our findings demonstrate that, under shocks, high leverage worsens the portfolio return, volatility, and value at risk. The results further point out that optimal portfolio composition is obtained through a high proportion of low debt funds in the case of two separate equity funds, of low debt and high debt portfolios respectively. The systematic risk of several portfolio strategies is further explored with regards to a benchmark of European index and market-wide, return and volatility shocks.

Keywords: Return, volatility, portfolio leverage, European Stock Market, Mean Variance Efficient Frontier, Islamic stock screening

1. Introduction

The volatility phenomenon is an intrinsic behaviour of the capital market to which both investors and regulators should pay attention. While investors detest risks and seek greater returns, they may accept more risks in exchange for higher returns (Fischer, 1991). Granted that investors are tempted to add any stock to their portfolio to earn higher returns; it is essential that they consider leverage as a factor since the latter would inform them of the degree of risk they are taking. Therefore, information of a firm's debt (leverage) plays a significant role in decision-making within a portfolio management framework to ensure the optimal allocation of resources.

Compared to conventional finance, the Islamic capital market has its own set of legal and ethical rules which are mainly standardised by the AAOIFI (Accounting and Auditing Organization for Islamic Financial Institutions). Those rules are pertaining to the prohibition of interest rate in the loan process, whereby investments should be anchored to the real economy with Islamically defined ethical constraints. Such rules further prohibit an excessive level of debt, uncertainty (*gharar*), and excessive risk positions at the level of any investment.

According to Islamic finance perspectives, low and moderate risk investments should be encouraged to secure financial conditions (Causse, 2009, 2010; Jouini, 2009). It is aimed at encouraging greater social responsibility through the defined Islamic moral values, and sustainable finance; all of which contribute towards more stability in the market (Al-Suwailem, 2012). The debt ratio limitation suggested by *Shari'ah* screening of threshold level of 33% is considered as a main rule of Islamic stock screening. Accordingly, the *raison d'être* of this study is to examine the impact of such quantitative criteria (after applying qualitative screening) on investments in terms of risk and return profile measured by VaR. In other words, this study aims to, use this widely applied-methodology to confirm the impact of the 33% threshold rule in Islamic finance against excessive debt undertaking.

Since Islamic finance shares several of its underpinnings with ethical finance and ethical investing, it might be appealing to utilise the same methodology to other ranges of stocks and infer the impact of their debt level on portfolio return and volatility. In case the results might be alike namely, subsequent implications could consolidate the relationship between sound ethical investments, low leverage, as well as low volatility.

Furthermore, this study is among the initial attempts to analyse the impact of leverage on portfolios' return and volatility, in the European stock market, specifically for *Islamically* screened stocks. The study is similarly different in terms of the methodologies used in this area, as we use the debt ratio (debt to total assets) as one of its important criteria. The methodology is consistent with the Islamic boards of the Financial Times Islamic Index Series (FTSE International Limited, 2007), and the Morgan Stanley Capital International Islamic Index Series (MSCI, 2007).

In this paper, our aim is to combine portfolio theory and Shari'ah stock screening methodology to investigate, in a Multi-Country Analysis, the debt effect on the risk-return profile of European portfolios. This research is based on the AAOIFI rules related to stock Shari'ah screening in which the cut-off of 33% of debt over total assets makes this research fundamentally different from previous conventional papers tackling the issue of the debt on both return and risks of equity portfolios. We argue that among the key issues that we examine is the impact of the 33% threshold used in *Shari'ah* stock screening on the risk-return profile of portfolios. By using a single threshold across all firms and all compliant industries, we expect to have a specific outcome due to this specific feature which may make the risk-return profile not necessarily mean-variance optimal since a selection of high business risk firms whose optimal capital structure requires debt below 33% or low risk businesses that are under leveraged.

The issues addressed in this study are mainly; (i) to estimate the leverage effect on the portfolio's return and volatility during and outside the global financial crisis (GFC)-2008; (ii) to explore the changes in the systematic risk (beta) in the case of European portfolios, based on high and low debt strategies, as compared to the MSCI European index taken as benchmark; and; (iii) more broadly, whether the low leverage minimises the impact of financial shocks or not. The study, hence, aims to analyse the impact of leverage on volatility of different equity portfolios, from eight European countries, namely Austria, France, Germany, Italy, Spain, Sweden, Switzerland and UK, after determining the compliancy of stocks by employing the qualitative Islamic (*or Shari'ah*) screening method. It should be noted that to ensure Shari'ah compliancy, the qualitative method should be considered more important as it represents the initial phase as to whether a stock can be held in a *Shari'ah* compliant portfolio or not. By conducting the research in an empirical nature, we constructed portfolios with a certain number of firms divided into two categories, explicitly low and high debt firms based on the cut-off principle of 33%. The combined portfolios were likewise considered. Besides that, the MSCI Europe index is used as the benchmark to investigate the systematic risk of several portfolio strategies based on the low and high leverage. Furthermore, in this paper, we briefly explored the trade-off concept within the Islamic stock screening, as rigorous quantitative ratios can increase the quality of the assets, but also drastically reduce the size of the investment universe, and vice versa.

In terms of empirical process, we adopt the low and high debt portfolio strategies, and we apply tools such as the portfolio optimisation based mean-variance efficient frontier (MVEF), the Sharpe ratio and the capital market line (CML) to estimate the leverage effect on the portfolio's return and volatility. In addition, cumulative return and volatility, alongside the MVEF line, are investigated. We conclude by analysing systematic risk (β) in relation to the MSCI European index.

The return and volatility in relation to leverage are examined by considering different sized portfolios constructed from a panel of 320 firms, qualitatively screened from more than 6,000 European firms. The selected firms are distributed over eight European countries (Austria, France, Germany, Italy, Spain, Sweden, Switzerland and UK) and classified by their level of debt and categorised in equally-like size portfolios. The optimal portfolio weights are computed for each quarter by maximising the value of Sharpe ratio, and then by using the cumulative normalised return based volatility and the cumulative normalised volatility based return. The CML has been added to determine the best portfolio in relation to the risk free rate in the European market. Finally, we explored the value of systematic risk (β) in the case of several portfolio strategies, based on high and low debt, with regard to the benchmark index. In the case of two separate equity funds of low debt and high debt portfolios, the results tend to indicate that optimal portfolio composition is obtained with high proportion of low debt fund compared to high debt fund. The presence of these effects is further examined through the response of the model's variables to market-wide return and volatility shocks.

By adopting this single cut-off of 33% related to the 'Total Debt' ratio, as suggested by AAOIFI ruling, our results tend to be conclusive regarding the Shari'ah debt cut-off of 33%, while at the same time, this specific impact of debt on the risk return profile of Shari'ah compliant portfolios cannot be taken as a priori. The results tend to indicate that total risk is, in major cases, less for low debt firms as opposed to high debt firms, the analysis is quantifying the amount by which the volatility is increased in the case of HD firms and for a specific threshold which is 33%. This threshold represents a specific feature (of stock Shari'ah financial ratio screening) related to the level of debt of a portfolio. If it is not respected, the firm should be screened out from the portfolio of Islamic compliant stocks. As explained in the following sections, we found strong evidence against the assumption asserted by Johnson and Neave (1996) that the MVEF shifts to the right due to the restrictions on diversification imposed by Islamic qualitative, and quantitative stock screening, which induces higher risk for the same level of expected returns. Our findings, however, is in line with the idea supported by Obaidullah (2006).

The rest of this paper is organised as follows: Section 2 presents the literature review; while Section 3 presents the optimal portfolio, the CML, the portfolio optimisation based on the Sharpe ratio with a focus on two assets, and, also, on the computation of its systematic risk. We also define the portfolio evaluation and the European portfolio construction used in this study. In Section 4, we analyse the sensitivity, in terms of returns and volatility, of the proposed portfolio policies to changes in the leverage (low debt versus high debt). In Section 5, we compare the different strategies related to the portfolio evaluation. Finally, we present our conclusions and policy implications in Section 6.

2. Literature Review and Theoretical Background

The literature presented in this section aims to contextualise this study and, also, provide the necessary explanation of the theories and methods that have been used in this study. These include MVEF, the CML, the Sharpe ratio maximisation, the marginal utility obtained at the First Order Condition (FOC) taken from the Asset Pricing Theory (APT) and the systematic risk for a portfolio with two assets. This is followed by an overview explaining the link to the framework of this paper.

2.1 Literature review

When regulating the financial system, the volatility phenomenon seems to emerge, as an intrinsic practicality in the capital market behaviour. Theoretically, the leverage of the firms appears to be a major determinant of the volatility of prices and returns. Investors, therefore, are interested in maximising the return and minimising the risk of their portfolios by finding the best optimal-weighted portfolio under the mean-variance optimisation. Since the most important input in this approach is the expected return [E(r)], Ziemba & Chopra (1993) have shown that estimation error in the expected return [E(r)] is 10 times as important as estimation error in the standard deviation (σ), and 20 times as important as estimation error in the correlations (ρ). Therefore, they have to hold a portfolio on the MVEF, which was first defined by Markowitz (1952) under the two following assumptions: (i) the normality distribution of the returns, (ii) the quadratic form of the utility function by which investor preferences are well approximated by returns and variance (Gholamreza *et al.,* 2010). Another assumption held is that the probability distribution function of the asset returns should be known (Vercher *et al*., 2007). However, in the real world, those assumptions never hold (Grootveld & Hallerbach, 1999; Konno *et al.,* 2002; Coleman & Mansour, 2005; Estrada, 2006). In fact, ignoring skewness and kurtosis may create riskier portfolios in relation to the presence of asymmetrical efficiencies in mean-variance analysis (Markowitz, 1959). Nevertheless, we could use this approach as a comparative tool with asymptotic trends to test the leverage effect on the portfolio return and volatility, as we are not concerned with an accurate return and volatility.

According to Huang (2008), portfolio selection is one of the pertinent issues in finance. A selection of a combination of securities may optimally fulfil the investors' objectives. For example, Adler and Kritzman (2007) used a full scale optimisation to accommodate any type of return distribution. Any description of investor preferences yields 'truly' In-Sample Optimal portfolio. Choueifaty and Coignard (2008) introduced the notion of 'maximum diversification' portfolios through a measure called 'diversification ratio' as ratio of asset's weighted average volatility to overall volatility. It measures diversification gain from holding uncorrelated assets; and a higher 'diversification ratio' will show a more diversified portfolio.

Maillard *et al.* (2008) have introduced the 'equal risk contribution' as a risk contribution based on the weight of asset times the marginal contribution to risk. Accordingly, achieving a risk parity remains experiential in nature.

By examining the optimal strategic allocation in the presence of estimation risk, Amenc and Martellini (2002a) focused only on the efficient frontier based on the variance–covariance portfolio estimation. They demonstrated that the volatility of the minimal variance portfolio is significantly lower than that of a naively diversified portfolio (*i.e.* an equally weighted portfolio). In extending the research, Polasek and Pojarliev (2004) compared the performance of different strategies with the MSCI (Europe index as benchmark) using VAR-GARCH model for European countries. Their analysis is supported by calculating the cumulative return, Sharpe ratio, geometric mean, and success rate. They concluded that multivariate volatility timing strategies outperform the benchmark index and even a small country can be used to contribute to a better overall portfolio return. Thus, portfolio managers ought to watch closely volatility trends, as changes in prices could have a major impact on their investment and risk management decisions (Kalotychou and Staikouras, 2009).

A number of empirical studies in the literature aimed at creating sampled portfolios from various part of the world by subjecting them *Shari'ah* screening with the objective of examining their risk-return performances. Among such studies, Asutay & Hendranastiti (2015) examine the risk-return of selected FTSE 100 portfolios to determine the impact of *Shari'ah* screening on their performance. They found that *Shari'ah* screened portfolios performed better during the financial crisis as compared to socially responsible stocks. They further concluded that *Shari'ah* portfolios can be an essential instrument to hedge crisis while they found the significant impact of sectoral factors impacting the portfolio returns for the selected sample.

2.2 Optimal portfolio for investors

The MVEF and the CML, using the risk-free rate as the intercept, allows for the Sharp ratio maximisation (William Sharp, 1994).

Since the conventional interest rate is not allowed within the Islamic finance framework, due to Naqvi's (1986) assertion that the absence of the risk-free assets, the CML in Islamic economy will lead to a welfare loss in the Islamic portfolio investment under the convexity assumption. However, Tag El-Din (1991) opposed the Naqvi's hypothesis by arguing that the convexity of investor's utility indifference curve assumption is valid only under many restrictive assumptions.

Moreover, the Islamic stock screening puts restrictions on diversification possibilities as the qualitative screening excludes some prohibited sectors. In addition, the quantitative screening of financial ratios through the debt and liquidity ratios and interest-bearing returns reduces the investment universe of firms in which Muslims may take position as investors, and hence a shift of the MVEF to the right due to higher risk for the same level of expected returns (Johnson and Neave, 1996). However, Johnson and Neave (1996) did not provide any strong evidence to support their assumption.

According to the Islamic finance perspectives, the risk-free asset may be approached using, for example, short term *sukuk* (asset-backed securities) in the form of short term *ijarah sukuk* certificates that could be issued by the government, or big corporations with very good ratings, even *sukuk* are more likely to have higher return than that of risk-free (Obaidullah, 2006). The rationale behind it is that, those assets have to be free from risk of default, and hence, should be constructed in the way to be as safe as possible by making their correlation with the equity market returns negligible. The latter point could be possible if the *ijarah sukuk* could be related to governments, very solid corporations, or very big *waqf,* or pious foundations. In fact, combining the short term *sukuk* asset with the MVEF can reach superior portfolios and offers additional efficiency using mathematical optimisation. With a quasi-riskless short term *sukuk* asset, all investors should hold the tangency portfolio. This portfolio maximises the trade-off between risk and expected return. It is very well-known in the theory of finance, however, that financial leverage is correlated with the level of risk which represents undiversified risk (Modigliani and Miller, 1958). Moreover, the costs implied by the probability of financial distress due to bankruptcy costs and its indirect costs can increase considerably the total risk while, low debt firms are more likely to have low risk. This will expand the universe of financial assets and increase the diversification opportunities by shifting to the left the MVEF as supported by Obaidullah (2006).

2.3 The capital market line and capital asset line

The Capital Asset Line (CAL) with the highest Sharpe ratio is the 'Capital Market Line' (CML) with respect to the tangency portfolio. In other words, in equilibrium, the market portfolio is the tangency portfolio which is called the CML. This achieves the optimum risk-return combination by forming optimal portfolio from risk-free securities and market portfolio. The maximum Sharpe ratio is obtained as the tangency portfolio to the efficient frontier. It appears that the tangency portfolio will move higher along the efficient frontier if risk-free securities increase. The area below the efficient frontier is a non-optimal portfolio composition in the mean-variance framework.

Risk-averse investors prefer lower risk for an expected return, as investors accept high risk investment only if the expected return is greater. Investors hate losing more than they love winning as investigated by Bernartzi and Thaler (2001) by using the concept of loss-aversion which is well known in behavioural finance. The optimal portfolio for the investor will be the curve with the higher utility and intersection with the CML which is obtained with the maximum of Sharpe ratio.

2.4 Sharpe ratio optimization and optimal portfolio for the investor

The Sharpe ratio (Sharpe, 1966) is one of the earliest and the best-known example of the performance evaluation method for a portfolio (Carlson 1970; Amin and Kat, 2003; Aragon and Ferson, 2006). It is given as follows:

$$\mathrm{SR} = \left(\frac{r_i - r_f}{\sigma_i}\right) \tag{1}$$

Where

r_i is the return of the firm i

r_f is the risk free return of the market

σ_i is the standard deviation of the equity's return

To be able to use the Sharpe ratio, we compute risk-free assets available for investment based on the mean of short-term interest rate for the eight European countries. In general, the optimal portfolio weights are computed for each quarter by maximising the value of Sharpe ratio using the expected return (minus the mean risk-free return) of a portfolio and its volatility. Specifically, a portfolio with the maximum Sharpe ratio is represented by the intersection between the tangency portfolio between the CML and the efficient frontier curve.

In this study, the risk-free return refers to the mean of short-term interest rate of the eight European countries. Furthermore, transaction costs are supposed to equal zero between trading quarters. The VaR has to be at its minimum and this is also implemented in the optimisation model.

So, we need to find the weights for a portfolio of minimum variance that has a fixed expected return. The minimum variance is reached at the point with the lowest possible variance. Finding the portfolio with the lowest variance for a given expected return will provide the mean-variance frontier based on the marginal utility obtained at the 'first order condition' (FOC) used in the asset pricing theory (Back, 2010).

As for the optimal portfolio for the investor, the optimal-weighted portfolios are constructed on a quarterly basis, where the allowed VaR is set to a confidence level of 5% for each portfolio. Interaction effect among a variety of equities led to a more complex decision-making on the weighting of shares. This involves assessment of the whole portfolio, all inter-correlations between its different pairs and its total diversification.

When the factors change (for example - leverage goes up or down), the sensitivities of stocks may be affected by it. This is called the 'Active Factor Risk' which relates to the particular stocks that have been picked by the portfolio manager and their subsequent performance and volatility. The 'active factor risk' directly affects the portfolio behaviour.

Two types of risk should be taken into account by the portfolio manager having a number of stocks in its equity fund which are exposed to macro and micro-economic factors: (i) the portfolio's sensitivity changes in relation to active factors; and (ii) the portfolio's return and volatility change when we add or remove the individual stock in the portfolio (called 'active specific').

2.5 Portfolio optimisation in the case of two assets

By using the Lagrangean multiplier, the FOC in the case of a portfolio of two assets and with minimum variance is given as follows:

$$w_1^* = (\sigma_2^2 - \sigma_{12})/(\sigma_1^2 + \sigma_2^2 - 2\,\sigma_{12}) \qquad (2)$$

w_1 is the weight of the first portfolio, σ_1 and σ_2 are the standard deviation for the portfolios 1 and 2. σ_{12} Is the covariance between portfolio 1 and 2.

By applying the second derivative from the FOC based on the diversification principle, we get:

$$\frac{\partial \sigma_p^2}{\partial w_1}\,(w_1 = 0) \;=\; 2\,\sigma_1\sigma_2\left(\rho_{12} - \sigma_2/\sigma_1\right) \qquad (3)$$

$(1 - w_1)$ will be the weight of the second portfolio in the combination of the two portfolios in one.

If $\rho_{12} < 0$ or [if $\rho_{12} > 0$ but $\frac{\sigma_2}{\sigma_1} > \rho_{12}$], then $\frac{\partial \sigma_p^2}{\partial w_1}\,(w_1 = 0) < 0$, in this case, we should increase w_1 (*i.e.* buying portfolio p1).

If $\rho_{12} > 0$ but $\frac{\sigma_2}{\sigma_1} < \rho_{12}$, then $\frac{\partial \sigma_p^2}{\partial w_1}\,(w_1 = 0) > 0$, so we should decrease w_1 (*i.e.* selling portfolio p2).

2.6 Systematic risk for a portfolio with two assets

In general, the systematic risk β_i $for\ equity\ i$ is given as follows:

$$\beta_i = \frac{\mathrm{cov}(r_i, r_m)}{\sigma_m^2} \qquad (4)$$

where:

r_i and r_m are the return of the equity i and the return of the market benchmark,

σ_m is the variance of the return of the benchmark.

In the case of two assets (1 and m), the systematic risk β_1 is expressed as:

$$\beta_1 = \rho_{1m} \left(\frac{\sigma_1}{\sigma_m}\right) \quad (5)$$

4. Islamic Stock Screening Methodology

As for European portfolio construction in relation to *Shari'ah*-compliancy approach**,** AAOIFI guidelines (2010) are referred to, as AAOFI sets standards for Islamic banking and finance industry. These standards relate to negative criteria such as non-compliant business activities (e.g. alcohol, gambling, etc.) are excluded, while specific financial ratios are set as the watermarks, which should not be exceeded. The latter is a conservative measure prescribing, inter alia, the reduction of the negative impact of financial risk.

Derigs and Marzban (2008) have proposed a new paradigm for Islamic compliant portfolio construction, in which rather than measuring compliance for individual stock, they have considered compliance on the portfolio level. They have shown that the latter performs much better than the former in terms of risk-return profile.

The following aims to briefly describe the different portfolio strategies used for the eight European countries. In determining the portfolio that can be considered *Shari'ah* compliant, first we used the qualitative *Shari'ah* screening method by removing the companies specialised in non-permissible business, which were identified through normative *Shari'ah* principles. As for the quantitative screening, *Shari'ah* principles suggest that companies less than 33% of debt can be considered as *Shari'ah* compliant. Thus, for each firm the weights are determined by the following simple formula:

$$\text{D2TASSETS} = \text{Total Debts} / \text{Total Assets}$$

Accordingly, portfolios are classified into three categories: (i) low debt (LD); (ii) high debt (HD); and (iii) the combined portfolio (LD + HD) based on the debt ratio threshold. This threshold is determined as the ratio of total debt to total assets of the portfolio. It is computed as follows:

High Debt: HD (D2TASSETS > 0.33) and Low Debt: LD (D2TASSETS <= 0.33)

The total weights of each portfolio is equal to 1 and determined by the following simple formula in which $\mathrm{w}_{\mathrm{i,t}}$ is the weight of each firm within the portfolio:

$$\Sigma\, \mathrm{w}_{\mathrm{i,t}} = 1$$

As discussed in the literature review, since this study is not concerned with an accurate return and volatility, we can apply the MVEF approach with its limitations as a comparative tool with asymptotic trends to test the leverage effect on the portfolio return and volatility.

Our aim, hence, is to evaluate the effect of leverage on the return and volatility of a portfolio selection by empirically estimating three different strategies: (i) low debt portfolio strategy; (ii) high debt portfolio strategy and finally; (iii) the combined portfolio strategy, and ultimately subsequently implementing the model based on these strategies.

4.2. Portfolio evaluation

In order to compare the results of the different portfolio strategies for different quarters and different returns, we use the buy-and-hold portfolio strategy, and then we apply the cumulative normalised variables to all possible optimal portfolios evolving alongside the mean variance efficient frontier line by keeping the same set of equities and allowing their weights to change. This allows us to compare the total risks (respectively return) of the universe of low debt portfolio with its counterpart of the high debt portfolio. The MSCI Europe index is used as a benchmark for our comparison by quarterly computing its returns and volatility.

In our portfolio evaluation throughout the study period, we use the following criteria:

(i) The cumulative normalised return based volatility is calculated as the integral function of the return related to the volatility, as below:

$$Cumulative\_Return|_{Sigma} = \int_0^1 r_i \left(\frac{d\sigma_i}{\sigma_{max}-\sigma_{min}} \right) \tag{6a}$$

Where return is the quarterly portfolio returns and the range of the volatility = $(\sigma_{max} - \sigma_{min})$

(ii) The cumulative normalised volatility (standard deviation) based return is calculated as the integral function of the volatility related to the return, as follows:

$$Cumulative\_Sigma|_{Return} = \int_0^1 \sigma_i \left(\frac{dr_i}{r_{max}-r_{min}} \right) \tag{6b}$$

Where sigma is the quarterly portfolio returns and the range of the return = $(r_{max} - r_{min})$

(iii) The Sharpe ratio for quarter is defined as the expected excess return of the portfolio divided by the standard deviation of the portfolio. Using the equation (1), we compute the Sharpe ratio as the ratio of the average return and the standard deviation of the returns for the same quarter.

4. Source of Data

Datastream is used to collect the data from eight countries (Austria, France, Germany, Italy, Spain, Switzerland, Sweden and the UK) of 320 European industrial firms from 2008 until 2013. The data, is equally distributed between the eight countries based on qualitative Islamic screening which excludes activities such as tobacco, gambling, defence, conventional financial, and banking institutions *etc*. Quarterly standard deviation is then computed based on daily return for each firm over a five-year period. Furthermore, bank holidays and weekends are excluded in the studied data set.

The data sets for quarters are presented in a matrix consisting of 20 rows and an equal number of the size of the portfolio as the number of columns. Thus, we have constructed a return matrix and standard deviation matrix. By using MATLAB, we obtained the correlation matrix using the function *corrcoef* applied to the return matrix and the standard deviation matrix. Then, the covariance matrix is computed before determining the MVEF with the optimal portfolio weights for each quarter. Based on the risk-free rate collected as the mean of the eight risk-free rate of the studied countries, the CML is calculated where its tangent coincides with the Sharpe ratio. In the estimations, the area below the MVEF is in correspondence with the non-optimal portfolio composition in this framework.

Different sized portfolios are considered and constructed taken from a panel of 320 firms distributed over the eight European countries and classified by their level of debt and size. Before computing the matrices of returns, weights, correlations and volatility, we have constructed portfolios with the same quasi-equal size based on the portfolio total assets and debt as the criteria for portfolio selection strategy (D2TA). In this, quasi-equal size is determined by tolerating the 10% difference in size of the portfolios.

5. Findings and Discussion

Based on the research methodology defined above, this section aims to present the results relating to the effect of debt on different sized portfolios by measuring their return and volatility according to the three strategies mentioned above (LD, HD and LD+HD). In other words, empirical evidence is presented in relation to the investigation conducted as to whether lower leverage could bring less volatility to the stock market as recommended by the Islamic finance principles.

To be able to capture the leverage effect on the return and volatility, in the empirical process we apply various tools: the MVEF, the Sharpe ratio, the FOC, the cumulative volatility, and return-risk profile using VaR. We conclude by benchmarking the systematic risk, the cumulative volatility, and the return with the European S&P stock index in the case of low debt and high debt fund strategies.

5.1. MVEF in the case of combined portfolios

As a starting point, we have considered three portfolios: (i) A portfolio of 91 LD firms, (ii) a portfolio of 91 HD firms; and (iii) as a combined portfolio of LD+HD low and high debt portfolios having 182 firms. We computed the MVEF using the three portfolios above. The results are presented in the Figures 1a -1c for the first 10 quarters (from Q1 to Q10). The results for Q11 to Q20 are depicted by Figures 1d -1f.

As can be viewed from Figures 1a and 1b, and Figures 1d and 1e, for the all studied quarters, the LD strategy has its MVEF curve located in the left (of the *x* axis) compared to the HD strategy. This is in line with the finding of Obaidullah (2006); however, contrasts with the assumption supported by Johnson and Neave (1996), that the Islamic stock screening makes a shift to the right of the MVEF due to higher risk for the same level of expected returns. Our finding can be explained by the fact that the Islamic quantitative screening excludes firms with high debt and hence removes those firms which have a high probability of financial distress, or high risk of bankruptcy.

[Figures 1a-1f here]

One of the interesting quarters to analyse is the period of the GFC-2008, or as illustrated by Q2. Figure 1c that during the GFC-2008, the combined 182 firms portfolio of high and low debt has very large variation volatility coupled with negative returns compared to the 91 firms portfolio of low debt for the same period of time (see Figure 1a). This shows that the diversification posed no advantage during the period of GFC-2008, whereas the low debt portfolio seemed to be offering more protection in terms of low volatility.

During this period investors who sought a higher return (strictly higher than one), had to face an infinite value of volatility, because, as can be seen in Figure 1c, the curves become asymptotic to the horizontal line (blue-cyan colour). In other words, the return collapses while the volatility rises. It is the risk neutral investors who would keep to the same position regardless of the risks to earn their expected return. In reality, investors are more likely to be risk averse. They would like to invest when the mean variance frontier is steeper and nearly asymptotic to the vertical line in which any small increase in the volatility will bring a much higher return. This case nearly occurred during the quarter 1 in 2013 (Q20 in Figure 1e in the case of high debt portfolio strategy). However, quarter 3 in 2008 (Q6) shows more dispersal in the low debt portfolio in terms of volatility without offering noticeably better return than the combined portfolio. Meanwhile, the combined portfolio gives less volatility than the two previous ones. This could explain the fact that outside the period of the GFC-2008, a portfolio with high debt could offer less volatility than the one with low debt.

When we compare the results for LD with HD portfolio figures, quarter to quarter (curves with the same colour) in Figures 1a and 1b, and Figures 1d and 1e, we notice in most cases among the 20 studied quarters that low debt portfolio strategy shows less dispersion of volatility for the same level of return. Moreover, for the same level of risk, the LD portfolio strategy outperforms the HD one. When we turn to the combined portfolio, we discover it presenting less volatility than the two other portfolios. Therefore, we cannot conclude whether this last result, related to the combined portfolio, is due to the low debt effect, or to the diversification effect as the number of equity in the portfolio is relatively high (91 equities). Therefore, an additional analysis is conducted to elucidate the last mixed result produced in the analysis.

In Figure 2a and 2b, we have illustrated the return (respectively the volatility) for each quarter (from Q1 to Q20), for a volatility equal to 0.015 (respectively the return equal to 0.001). Figure 2a shows two quarters (Q3 and Q14) where the curves in both instances severely go down for the return and severely up for the volatility. The first one is during the GFC-2008 and the second one is during the peak of severity of the European sovereign debt crisis (2009-2011). The graphs infer clearly that the low debt strategy is safer than the high debt strategy in terms of volatility during the two shocks. Interestingly, during the European sovereign debt crisis, the level of volatility and return has stayed lower compared to high debt and combined strategies.

A striking result illustrated in Figure 2b is that during the Q14 (Q3-2011), the return drops further for the low debt portfolio than the high debt and the combined portfolios, while the volatility of the former portfolio stays very low compared to the latter. This is revealing the negative impact of external factors, rather than financial ones. The presence of this low volatility and the absence of its positive impact on the return, demonstrate that the high losses may not be due to the leverage effect, and its link to financial risk but to external shocks, for instance the European sovereign debt and its political implications. This necessitates taking into account both purely economic conditions and external factors, by using international diversification outside of European markets.

[Figure 2a here]

[Figure 2b here]

5.2. Sharpe ratio for individual and combined portfolios of European firms

In the preceding sections, we have optimised the weights related to the portfolios using the MVEF without taking into account the CML based on the risk-free rate. In this section, we discuss the maximum return-to-risk results by using the Sharpe ratio for the 20 studied quarters of the three strategies with 36 and 91 firms: LD, HD and combined LD+HD equity portfolios. The quarterly Sharpe ratio is computed by determining the weights of 30 different distributions of equities composing the portfolio and their risk-return profile. This allows us to locate the tangency point at the intersection between the CML and the MVEF curve corresponding to the maximum value of the Sharpe ratio.

[Figure 3a here]

[Figure 3b here]

Figure 3a shows that the LD portfolio (for 36 equities) presents the best Sharpe ratio compared to HD and the combined portfolios (36 LD + 36 HD equities). This infers that the LD strategy (black coloured line), outperforms HD (red coloured line) strategy, and the combined portfolio (cyan coloured line) for the whole studied period (20 quarters). As can be seen, there is a certain benefit to combine the LD and HD portfolios for the portfolios of 36 equities, while there is no benefit to do so in the case of 91 equities (see: Figure 3b). In fact, the values of Sharpe ratio are very close between the three portfolios, showing no benefit to combine the LD and HD portfolios because of the existing over-diversification phenomenon (91x2 = 182 compared to 36x2 = 72 firms).

The third point is the fact that there is a structural break in the Sharpe ratio, happening before and after the GFC-2008. The latter seems to be a break point in the economy: a decrease in the absolute value of the Sharpe ratio has become a permanent phenomenon for all the 18 quarters starting just after the GFC-2008 crisis.

We conclude from the above, that the maximisation of the Sharpe ratio brings new evidence supporting the positive impact of low debt on the portfolio risk and return.

5.3. Sharpe ratio maximised for the best combination between the low debt portfolio and high debt portfolio

In this section, we consider the two portfolios as separate funds that could provide efficient investment service without any need to buy individual stocks separately. We have to find the best combination of the two portfolios (LD and HD strategies) to get the best return with the minimum volatility. This leads us to establish the maximum value of the Sharpe ratio. However, in this case, two restrictive assumptions should be considered: (i) the investors care only about mean and variance of return called here (μ, σ_p), and (ii) there is a fixed investment horizon (buy and hold).

As per the FOC's derivation for the combination of the LD and HD portfolios (91 firms each) in Table 1 (Appendix), the correlation between fund 1 and fund 2 is negative ($\rho_{12} < 0$). This indicates that the portfolio formed as a combination of the LD, and HD portfolios is not optimised and we should increase the weight of the LD portfolio since the mean weight of the two portfolios in the combined one (by putting the two first portfolios in one unified portfolio) are 0.1397 for the LD and 0.8603 for the HD. In this composition, the formed portfolio of the two is not optimal. We should increase w_1(*i.e.* buying the portfolio p1) because the optimum is obtained under the two conditions: (i) ($\rho_{12} > 0$) and (ii) ($\frac{\sigma_2}{\sigma_1} > \rho_{12}$). It follows that investors should choose to put more weight on a portfolio with low debt than the one with high debt to maintain higher pair of (μ, σ_p), as explained in section 2.5.

Therefore, to obtain the best market portfolio, the relative proportion of the low debt portfolio should be always higher than the weight of the high debt portfolio regardless of the level of the Sharpe ratio values. The next section shows that it is possible to get a higher μ for the less volatility by providing more weight to the LD portfolio.

5.3.1. Case of two separate equity funds

In this section, we have maximised the Sharpe ratio from the combination of two separate funds in one unified portfolio in the two cases, namely; 46LD+46HD and then 91LD+91HD. The results are depicted in figure 4, which is based on Table 2 (Appendix). As the results demonstrate, investors should give more weightage to a portfolio with low debt, than the one with high debt to maintain higher pair of (μ, σ_p) for the two separate equity funds in the case of the 46 firms and 91 firms throughout the studied period.

[Figure 4 here]

Logically, wise investors, may drawdown their investments from high leveraged portfolios in favour of low leveraged portfolios. We may, therefore, infer a sound rationale of Islamic stock screening. It is worth mentioning that, within the same combined portfolio of the 92 firms (46 LD and 46 HD firms with quasi-equal size), the total proportion of low debt firms' weights (based on their total assets) is lower than the total proportion of high debt firms' weights (Table 3).

We concluded that, in the case of two separate equity funds of low debt versus high debt, the optimal portfolio composition is obtained with high proportion of low debt funds. This is consistent with financial theory and highlights the negative impact of high debt over the portfolio return and volatility.

5.4. Cumulative volatility and cumulative return

In this section, we investigate the leverage effect from a different perspective by considering the total return (respectively, total volatility), for any possible portfolio, throughout the MVEF curve based on the whole volatility domain in the *x* axis (respectively, the whole return domain in the y axis), between zero and one, since the volatility (respectively, the return) is normalised based on the formulas given in the equations (6a) and (6b).

Tables 4, 5, 6 and 7in Appendix summarise the results of the cumulative return and total volatility according to the criteria defined in Section 2.7 (Portfolio Evaluation) (*see*: Figures 5a, 5b, 6a, 6b and 6c). In this section, we compare the three following schemes of cumulative return and volatility: LD, HD and combined (LD+HD) portfolios over 20 quarters of the evaluation period for the quasi-equalised portfolios with 91 (Figures 5a and 5b), 46 (Figures 6a and 6b), and 92 firms (Figure 6c).

With regards to 'cumulative normalised return in the case of 91 firms', Figure 5.a depicts the quarterly accumulated portfolio return, which is computed as the integral of all possible weights for the same set of equities. The cumulative return is computed, for all possible value of sigma, by following the optimal trading strategies alongside the MVEF line. This is repeated for each quarter using the formulas in the equations (6a) and (6b).

First, the combined portfolio presents the best option in terms of high return at any point of time for the whole studied period. This confirms the diversification benefit even in the case of portfolios that seem to be over-diversified.

[Figure 5a here]

The results for the 'cumulative normalised return' in Figure 5a show that the three portfolios (91 LD, 91 HD and combined 182 firms) move together following the same trend. However, LD and combined portfolio (LD+HD) more closely from quarter Q3 (Q4-2008, just at the time of the GFC-2008) to quarter Q12 (Q1-2011) after which, HD portfolio starts to join the returns of the combined portfolio. Meanwhile, the LD portfolio yielded less return than the others. During and just after the GFC-2008, the two portfolios LD and (LD+HD) seem to be a good strategy to use.

With regards to the 'cumulative normalised volatility as standard deviation in the case of 91 firms', Figure 5b illustrates the quarterly accumulated portfolio volatility generated by the optimal trading strategies alongside the MVEF line computed for each quarter using the formulas in the equations (6a) and (6b). The combined portfolio presents the best option in terms of reduced volatility at any point of time for the whole studied period. The results show again that the three portfolios move together following the same trend. The LD presents a good option during the GFC-2008 (during the first six months and from Q13 to Q20) in relation to volatility.

[Figure 5b here]

As for 'cumulative normalised return and volatility in the same graph in the case of 91 firms', to get a more precise insight, we arrange the previous results using the 'bar' illustration in Figure 5c. In Figure 5d, we illustrate for each quarter the percentage change in total volatility and total returns, namely $\Delta\sigma = \frac{\sigma_{HD} - \sigma_{LD}}{\sigma_{HD}}$ and $\Delta r = \frac{r_{HD} - r_{LD}}{r_{HD}}$, to analyse the trade-off between the returns and volatility benefit. The idea is to measure the percentage decrease in volatility coming from 'low debt' effect and the amount of return must be given up while gaining this stability. Conversely, we seek to measure the percentage increase in the return due to the 'low debt' positive effect, and at the same time the percentage increase in volatility due to the 'high debt' negative effect.

Figure 5c shows that we have more cases where the benefit in terms of stability (less volatility) and relatively less return are in favour of LD compared to HD strategy. In fact, it also shows that we have 12 quarters where we have more stability and 6 other quarters in which we have higher return in favour of LD portfolio. In fact, when comparing the amount of changes (as percentage) in volatility and return for LD and HD portfolios (Figure 5d), we observe a decrease in volatility of 4.9% (($\Delta\sigma$ = (0.1226 - 0.1166)/ 0.1226), while there is a decrease in return of 1.8% (Δr = (0.0400- 0.1166)/ 0.0400). Interestingly, to get a decrease of 4.9% in volatility, 1.8% in return has to be given up. Thus, increased stability requires a trade-off on the account of return.

[Figure 5c here]

[Figure 5d here]

As per theory, investors cannot simultaneously increase return and reduce risk. However, our finding shows that, when assessing the leverage effect, increasing return and losing in stability (increase in volatility) show a non-linear relationship. They should consider the asymmetrical trade-off between risk and return. More precisely, when the investors give-up one unit in return they gain 2.7 units in stability, subsequently having less volatility (or gaining more stability) in their portfolios return.

With regards to 'cumulative volatility, return and Value at Risk' in the case of 46 LD and 46 HD firms and all the 92 firms, the findings in Figures 6a-6c depict that all the three portfolios move together following the same trend in terms of return, volatility, and VaR. Certain peaks are reached regularly with a particular highest one at quarter 11 (Q4 in 2010) exactly during the intensified concern about the European sovereign debt crisis, which started from October 2009 until the end of November 2011.

[Figure 6a here]

[Figure 6b here]

[Figure 6c here]

This crisis has pushed the European countries to implement a series of financial support measures such as the European Financial Stability Facility, and European Stability Mechanism (Alfonso *et al.,* 2012; Kilponen *et al*., 2012; Mink and de Haan, 2012; Baker *et al*., 2012; Mohl and Sondermann, 2013). Worth noting that this crisis has a worse negative impact on the European market than the GFC-2008 in terms of volatility and high losses for HD strategy, while comparatively the LD strategy has suffered less. As can be seen, those results are consistent with the Islamic stock screening principles based on debt ratio.

5.5. Cumulative normalised return and volatility benchmarked with European S&P

In this section, we have computed the cumulative normalised return and volatility according to the formulas in the equations (6a) and (6b). We have taken the S&P European stock return and volatility (both conventional and Islamic) as the benchmark for our comparison. Figure 7a (and respectively Figure 7b), show the cumulative returns (respectively, volatility) for the three portfolio strategies with 91 firms strategies besides the return Islamic and conventional for both S&P stock index return.

Concerning the portfolio of 92 firms, we have only considered the combined portfolio (LD + HD) strategy as we need to compare its behaviour with portfolios that have the quasi-same number of equities, which is the case of LD and HD portfolios of 91 firms. This allows us to have more accurate insight when comparing the portfolios' behaviour since the difference in the number of assets forming the portfolios will be removed.

As can be seen in the depicted results, while the Islamic S&P equity index has higher return and less volatility when compared to its conventional counterpart, both display less returns compared to the constructed portfolios. The situation is less clearer in terms of volatility, since the Islamic S&P equity index, in most cases except the case of (LD+HD) 92 firms portfolio, demonstrated less volatility compared with all the studied portfolios except during the case of the GFC-2008, and the edge of the European sovereign debt (quarter 3 of 2011).

[Figure 7a here]

[Figure 7b here]

It appears that the return (for both portfolios strategies of low and high debt) is almost synchronously in tandem with the movements observed in the conventional European S&P equity market, in terms of return and volatility, and to a lesser extent the Islamic European S&P equity market. The volatility of the constructed portfolios is also following the movements of the conventional European S&P equity market but with one quarter lag and in lesser extent with the trend of the Islamic European S&P equity market. Furthermore, the cumulative return of the constructed portfolios (except of the case of combined 92 portfolio) outperform the benchmark index in terms of return. This is in line with the findings of Polasek and Pojarliev (2004) according to which a volatility timing strategies outperform the market benchmark index.

5.6. Return, sigma and value at risk for a combination of two funds

This section presents the return, sigma, and VaR for the two portfolios (46LD & 46LD) as 2 separate funds across the 20 analysed quarters, and the depicted result in Figure 8.

[Figure 8 here]

Figure 8 shows that the return (line in black colour) and the normalised VaR (based return and sigma; with blue and cyan colours) are moving in opposite directions by which the high negative return (high in absolute value) is accompanied by high losses. However, it is important to note that the chain of shocks driving up and down the return while the volatility has been drastically reduced due to the combination of the two separate funds in one basket. This permanent swing of the returns and losses may infer the presence of a negative impact due to external factors and not only due to the effect of the financial factor, as the volatility has been offset by combining the LD fund and HD fund in one investment. In other words, this diversification has brought the volatility to a lower level which can be expected to drive high and stable returns.

The presence of low volatility and the absence of its positive impact on the return during shocks (such as the GFC-2008 and the European Sovereign debt shocks) reveals that the high losses may not be due to the leverage effect and its link to financial risk, but rather that this could be related to external shocks such as the European sovereign debt and its political implications. Therefore, it can be suggested that under such circumstances, investors should take into account other factors out of the pure economic and financial conditions of firms and may diversify their investments to benefit from international diversification (outside European stock markets) and to hedge against those external negative conditions. In particular, a diversified portfolio based on the sampled European countries may outperform, if we add to it a portfolio of emerging markets. The portfolio's volatility will be reduced by six percentage points while the return will stay unchanged, which corresponds to the findings established by Harvey (1995).

5.7. Systematic risk for a portfolio against S&P European market

We compute, for each quarter, the systematic risk of the portfolio in relation to S&P European stock return (conventional and Islamic) using the equation (5) in the case of two assets (each studied portfolio with the S&P index), for which the results are presented in Figures 9a and 9b. As can be seen, the beta of HD portfolios (36 and 91 firms) compared to the beta of the conventional S&P is high, while the beta of the latter compared to the beta of the Islamic S&P is low. Moreover, HD portfolio equity prices can be adversely affected by any small change in the conventional S&P index, while it presents only less exposure to change in the Islamic S&P. Interestingly, the beta of 36 LD portfolios compared to the beta of both conventional and Islamic S&P indices is particularly low (around 0.32). This confirms the fact that the sensitivity to market risk of 36 LD portfolios is not considerably sensitive to the conventional and Islamic S&P indices.

The beta of 91 LD portfolios compared to the beta of the Islamic S&P index is relatively low (around 0.7) compared to its values (around 0.8) against the beta of conventional S&P but more than two times higher than the beta of 36 LD portfolios (around 0.32). The 91 LD portfolio will have greater price fluctuations with any change in the conventional and Islamic S&P indices than the beta of 36 LD has with the same indices (Figures 9a and 9b). This type of sensitivity of European portfolios to conventional European S&P index that may induce price fluctuations must be taken into account by investors when selecting to invest in LD portfolio.

Finally, the 92 (LD+HD), 160 HD, and two-fund (160LD+160HD) portfolios have the quasi-same behaviour as the 91 HD portfolios. However, the gap between the two betas (conventional minus Islamic) is higher for the 91 HD firms than 92 (LD+HD) firms. This can be explained by the positive impact of the presence of the LD firms in the 92 portfolios.

[Figure 9a here]

[Figure 9b here]

[Figure 9c here]

As can be seen in Figure 9c, the beta computed against conventional S&P index (respectively against the Islamic S&P index) of 160 HD portfolios is 7.7% higher (respectively 7.1% higher) than the two-fund portfolios (as a combination of 160 HD fund and 160 LD fund). This shows the benefit of investing directly in the two-fund strategy (160 firms HD fund+160 firms LD fund) rather than in two individual portfolios (160 HD firms+160 LD firms) built on the same equities since the latter may have greater price fluctuations.

Figures 9a to 9c have the same trend of the systematic risk changes for both conventional and Islamic portfolios showing their vulnerability to the contagion effect. Interestingly all betas decreased singularly during the quarter just after the period of the GFC-2008, which can be explained by the large support granted by the European countries to the financial system. While this support is positive the effect is short-termed, observed here for only one quarter.

The figures (9a, 9b and 9c) show also a big gap between the values of beta for the portfolios with 36 firms, whereby, beta for high debt is higher than for low debt. However, the gap decreases when the size of the portfolio increases. This can be explained by the over-diversification occurring when the size of the portfolio becomes very high. From an investor's perspective, a low debt and small size portfolio presents a lesser risk compared to high debt, and big sized portfolios. Those results are congruent with the Islamic screening perspective which focuses on the leverage effect.

6. Conclusion

This study has examined the leverage effect on the return and the volatility of different portfolios with a particular focus on the GFC-2008 period. More than 6,000 European firms were considered initially, while in the end 340 of those were chosen based on a comprehensive available data in the European market.

In relation to the research questions developed in the beginning of the research, the findings show that (i) the leverage effect has direct impact on the portfolio's return and volatility; (ii) its effect is changing the systematic risk (β) depending on the two levels of debt: less than 33% and more than 33%. Outstandingly, the negative impact of the leverage is more visible during the GFC-2008 than outside this period of global shock; and (iii) more broadly, the low leverage has a big role in minimising the impact of financial shocks in terms of returns, volatility, and systematic risk when we are taking into account a longer-term investment (the period of five years in question).

Our approach, based on the MVEF reveals that low debt portfolio promotes, in most cases, more micro-stability to the market in terms of portfolio volatility. More precisely, the MVEF curve tends to move to the left for the LD strategy compared to the HD strategy. In all the studied cases (portfolios low debt compared to portfolios high debt), the proportion of the benefit coming from the LD portfolio volatility (compared to the HD portfolio volatility) is higher than the percentage reduction in returns (of the same portfolios).

Furthermore, an optimal portfolio in the case of two equity funds in this study demonstrates that low debt should have higher weighting than a high debt fund, for which the weight proportion is obtained with low and high debt equity fund. Overall, leverage seems to play a big role for portfolio returns, volatility, and VaR. Moreover, high leverage is indicative of having a big role in worsening portfolio returns and volatility under shocks. It should be noted that in most cases, the low debt portfolios management is quite successful and can give less volatility, and only a small portion of return to give up with low debt portfolios, when compared to high debt portfolios.

Additionally, the cumulative return of the constructed portfolios is generally outperforming the benchmark index in terms of return. This is congruent with the findings of Polasek and Pojarliev (2004), according to which a volatility timing strategies outperform the market benchmark index.

We, therefore, conclude that the returns of portfolios related to the high-level debt strategies for European countries can be improved considerably if those portfolios are combined with low-level debt strategies, while high-level debt strategies alone could be detrimental for the performance and volatility.

Overall, our findings, within the Islamic stock screening perspective, are broadly consistent with the theory within the capital structure of firms, in which financial flexibility, in the form of debt level, plays an important role in the stability of the portfolio return and its volatility. Future research could add to this analysis of systematic risk or beta through an exploration of both components in the form of financial risk and business risk.

In reflecting upon the findings in this study, firstly one can develop several policy implications. For example, regulators may need to issue standards on reducing excessive debt level (above a certain level of threshold) in listed companies in regards to its detrimental negative impact on business viability. Secondly, for investors, debt has a tax benefit to the firm while firm's risk is borne only by the stockholders (Hamada, 1992). Higher leverage increases the volatility and decreases the return beyond a point. This makes equity investment in the firm riskier. Investors may hesitate to participate in any new fund with portfolios constructed with high debt listed firms if the fund managers are not able to reduce the leverage of their portfolios. Therefore, investors may consider engaging in investment strategies in *Islamic* compliant companies which do not have high leverage and, hence, the risk-return profile of such portfolios would provide less volatility and sometimes high return. This may open a new way to the partnership based Islamic financial instruments such as *musharakah* or *mudarabah*, between the investors and fund managers. As equity and venture capital based Islamic financial instruments feature risk sharing and profit-and-loss sharing characteristics, and, therefore, they have advantages over fixed income Islamic financial instruments which mimics conventional financial instruments. It should be noted that it is the inherited objective of Islamic financing principles to control debt culture and expanding equity in a society.

In the light of the findings generated by this study in the case of sampled European samples, it is highly likely that any portfolio with high debt will have less risk adjusted return (defined as return over risk) than low debt portfolio. Individual portfolio returns are often changed very fast and with high volatility change. Specifically, the European capital market went into a period of economic tumult and confusion during and just after the global financial crisis 2008 indicating the global linkages between the stock markets. Thus, international implications of the findings of this study can be reflected in two different ways regarding the US and the Asian markets as the European stock markets are well integrated with the former and more or less integrated with the Asean markets. The international evidence produced by the existing literature shows that US business cycles play a dominant role in explaining the European stock market volatility, compared with the EU fundamentals. Also, fractional co-integration between The US and European stock markets indicating that the effects of shocks affecting the existing long-run relationship (Caporale *et al*., 2015). In the case of the linkages between European and Asian stock markets, there is regional volatility spillovers, and shock transmission from external stock over the ASEAN stock markets (Kabigting and De La Salle; 2011).

In highlighting the importance of regulation in controlling debt culture and further dis-embeddedness, Madrick (2014) has been critical about blind de-regulation, which as he suggests ‘seems to be like a governmental ideology’. However, technically, better transparency should be the practice of investment funds, as the fund managers should have the critical information to communicate periodically to the public, such as the level of debt, total volatility and systematic risk of their investment portfolios. This will enable investors to make appropriate choices between the high- and low-leveraged equity funds whereby at least self-regulation can be brought about by the informed preferences of individuals in relation to the debt level in the corporations they would invest in.

Furthermore, there is less doubt that market players and traders had manipulated markets Madrick (2014). As suggested by the findings in this study, speculation and outright manipulation often pushed the stock prices and their returns and volatility to unsupportable levels. Such results may be easily extended to some international financial markets such as the US stock market.

The findings established by this study, hence, has larger implications for the global financial system and also for Islamic finance, both of which are geared towards finacialisation with ever increasing debt culture. While after the last global financial crisis, reckless nature of financialisation was considered to be one of the culprits of the financial and economic meltdown, such criticism is no longer openly discussed in high tables in terms of restraining the debt culture. Therefore, the debt-culture remains an essential macro (country and corporation level) and micro (individual level) problem. As suggested by this study, as in the case of *Shari'ah* screening for debt threshold in terms of what level of debt can be acceptable should be considered as an important ethical and also financial protective measure to ensure the real economy and finance linkage in an attempt to prevent further dis-embeddedness of financial system from the real economy. Such a measure can also moderate the consequences of economic and financial crisis and can help with the development of a resilient system. Similar measures should be considered by the regulators to ensure taming of debt culture so that financial risk exposures created by heavy debt can be the moderated.

In concluding it should be noted that while Islamic finance was expected to be a moral compass to the global financial system in being exemplary in terms of embedding ethical criteria in financing through its risk-sharing contractual forms, including imposing debt threshold as an ethical criterion, the development and progress in Islamic banking and finance trajectory indicates an increasing pace towards financialisation through the use of debt based fix income contracts and also through their investment and financing preferences being directed to financial markets and real estate and construction sectors (Asutay, 2012). Thus, Islamic finance contributes to furthering of debt culture despite the ethical criteria set by Islamic legal norms but also by the instructions of the Prophet of Islam. By instituting such ethical and legal injunction, Islamic finance, in its essence, aims at preventing the making of indebted man and debt based business as opposed to the contemporary realities as critically examined and articulated by Lazzarato (2016). Hence, Islamic finance should also consider re-embedding itself in the 'Islamic ethical norms' to reduce risk exposure and contribute towards further resilience of financial system and economy in the global world.

In concluding, measures should be taken to help protect the global stock market from a damaging instability due to 'manipulative' informational cascade with systemic implications such as market crashes and recession. The global capital market may suffer from the disturbance caused by any very big firm that may go through a serious bankruptcy risk. This may be considered as negative externality of systemic risk that drives the whole financial markets into a high magnitude of instability or even failure. Since high debt can be considered increasing the risk exposure and volatility in the stock market, Islamic legal injunctions imposing a threshold level for debtness for corporations and also discussing the debt culture in macro and micro level can be considered as an important measure to develop a sustained growth and creating better and more efficient resilience.

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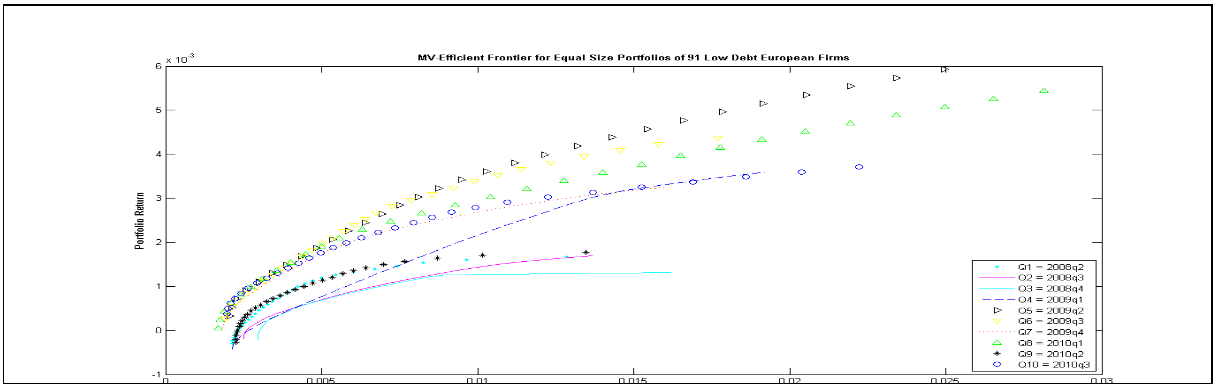

Figure 1a: MVEF for a Portfolio of 91 LD firms - Q1 to Q10

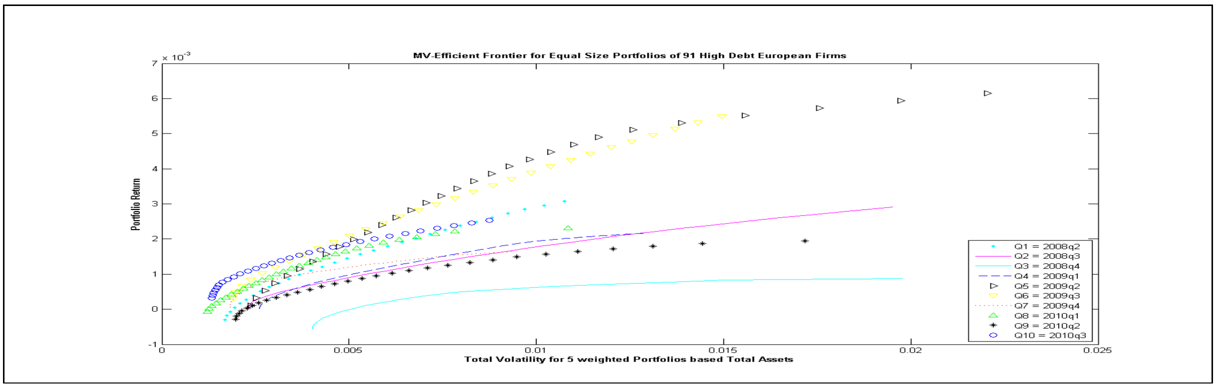

Figure 1b: MVEF for a Portfolio of 91 HD firms - Q1 to Q10

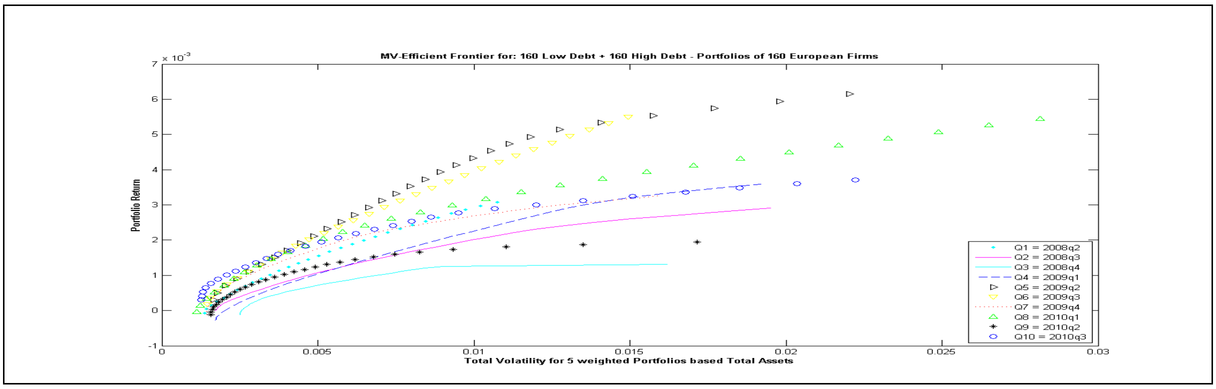

Figure 1c: MVEF for the two combined Portfolios: 91 LD + 91 HD firms - Q1 to Q10

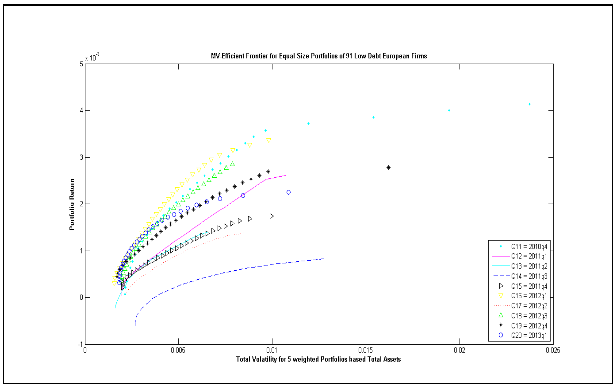

Figure 1d: Portfolio of 91 LD - Q11-Q20

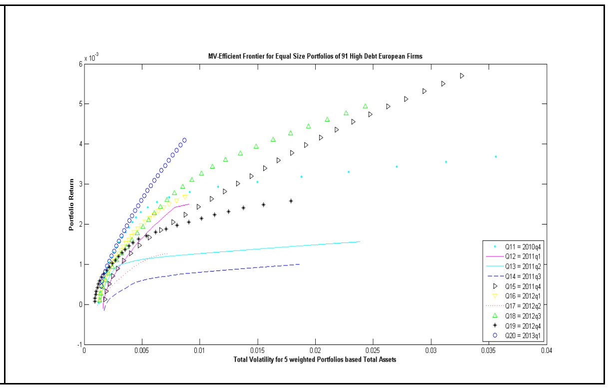

Figure 1e: Portfolio of 91 HD - Q11-Q20

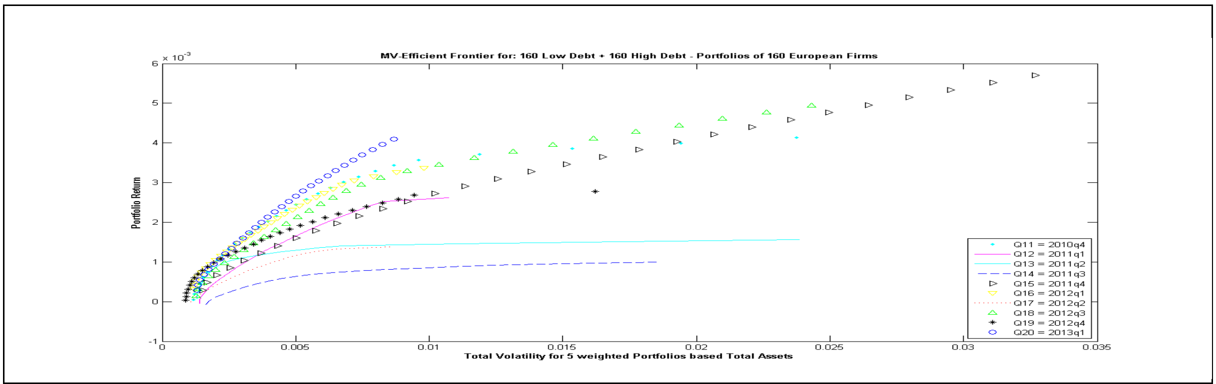

Figure 1f: MVEF for the two combined portfolios: 91 LD+91 HD firms - Q11- Q20

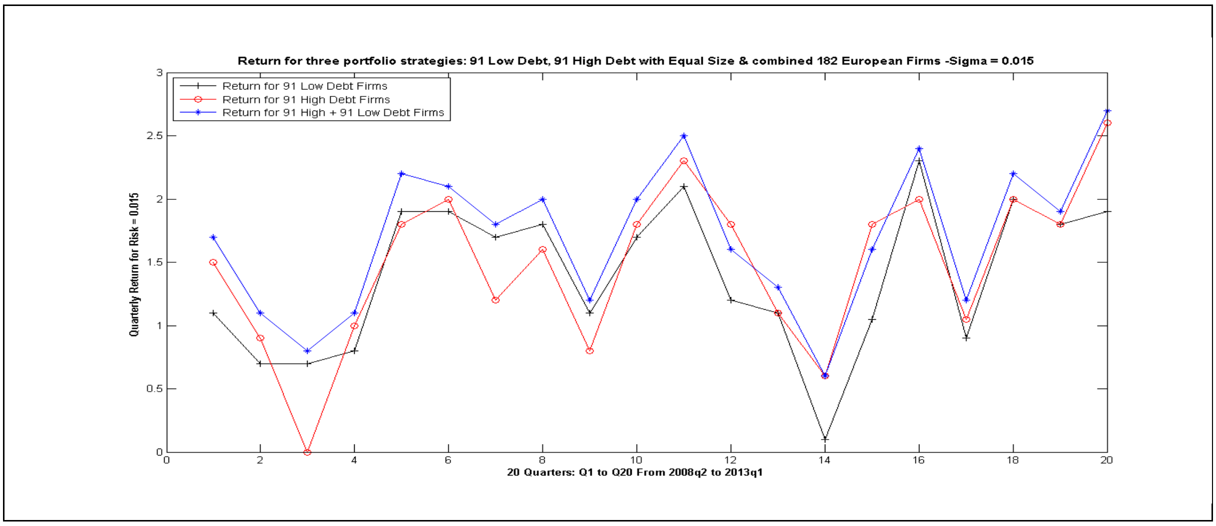

Figure 2a: Return for 3 portfolio strategies 91 firms: LD, HD & Combined 182; σ= 0.015

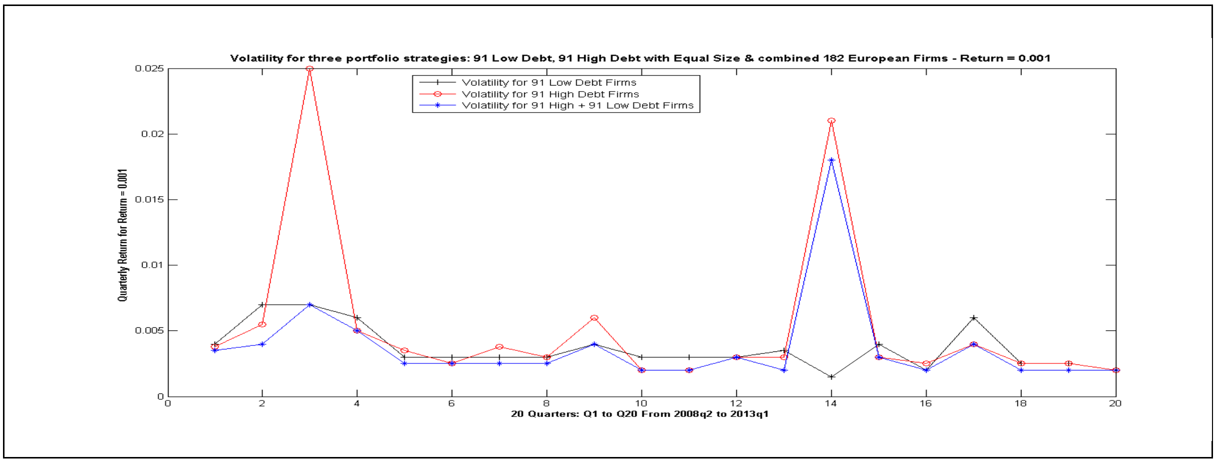

Figure 2b: **Volatility for 3 portfolio strategies 91 firms: LD, HD & combined 182; r=0.001**

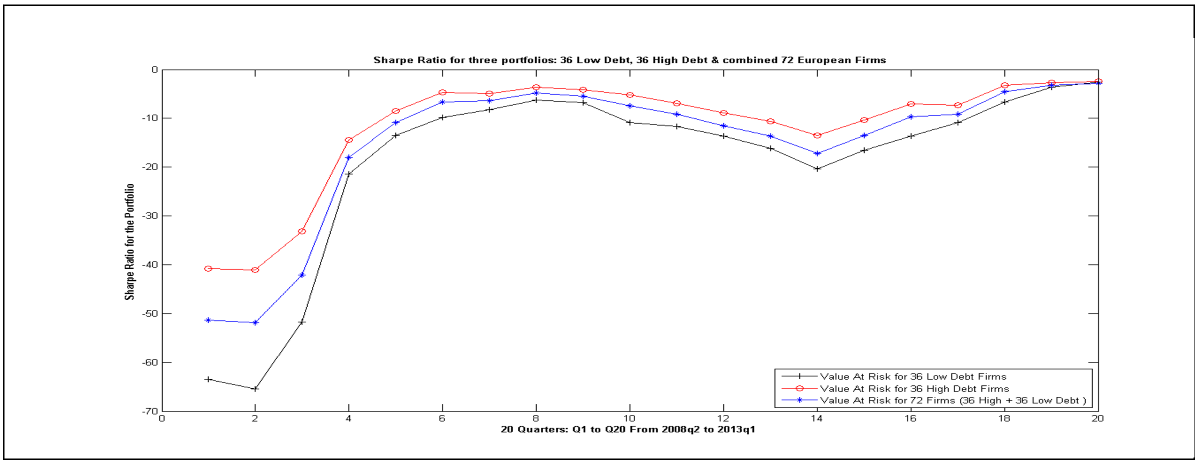

Figure 3a: ***Sharpe Ratio*** **for portfolios of 36 LD, 36 HD & combined 72 European firms**

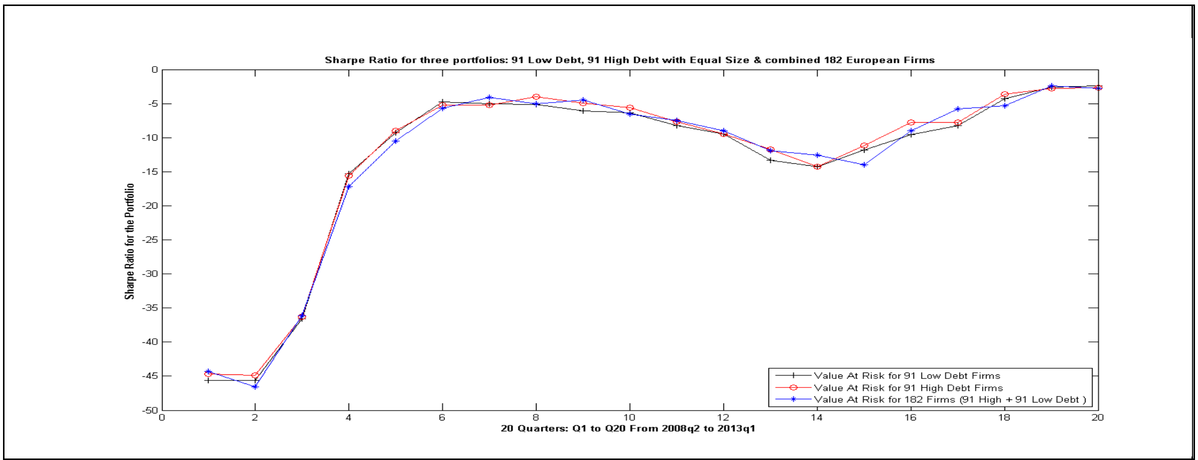

Figure 3b: ***Sharpe Ratio*** **for portfolios of 91 LD, 91 HD & combined 182 Firms**

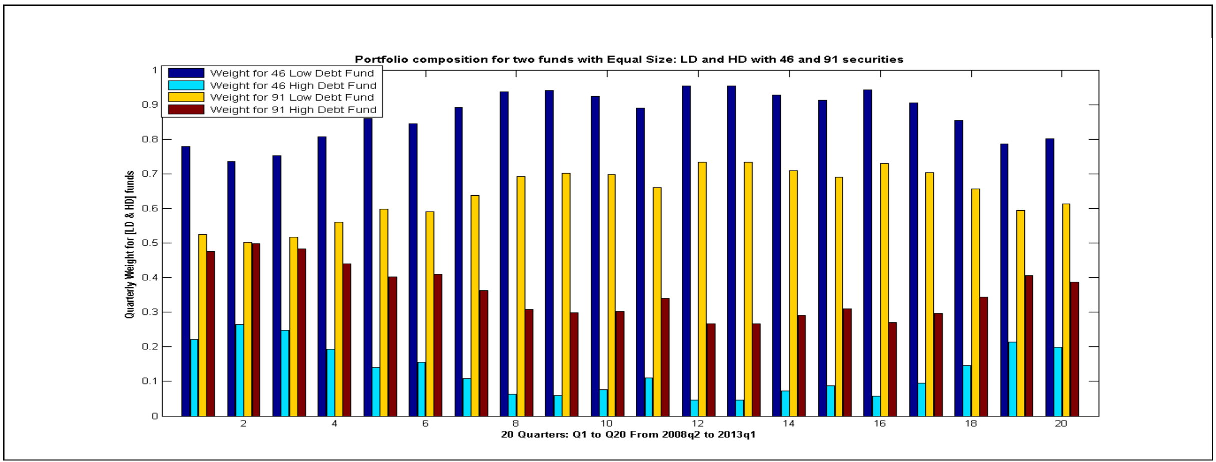

Figure 4: Portfolio composition, 2 funds: LD & HD with 46 and 91 securities

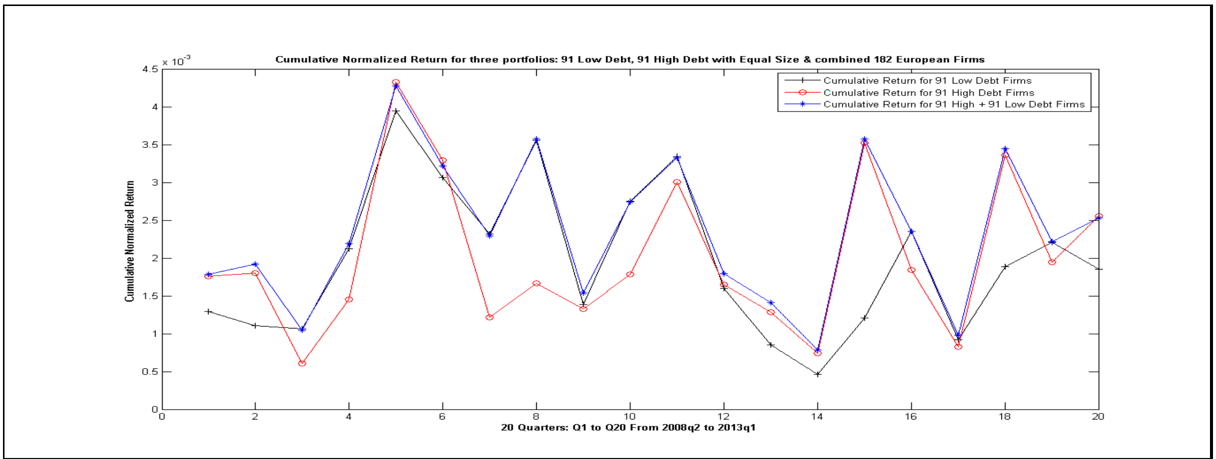

Figure 5a: Cumulative Normalized Return: 91 LD, 91 HD & combined 182 Firm

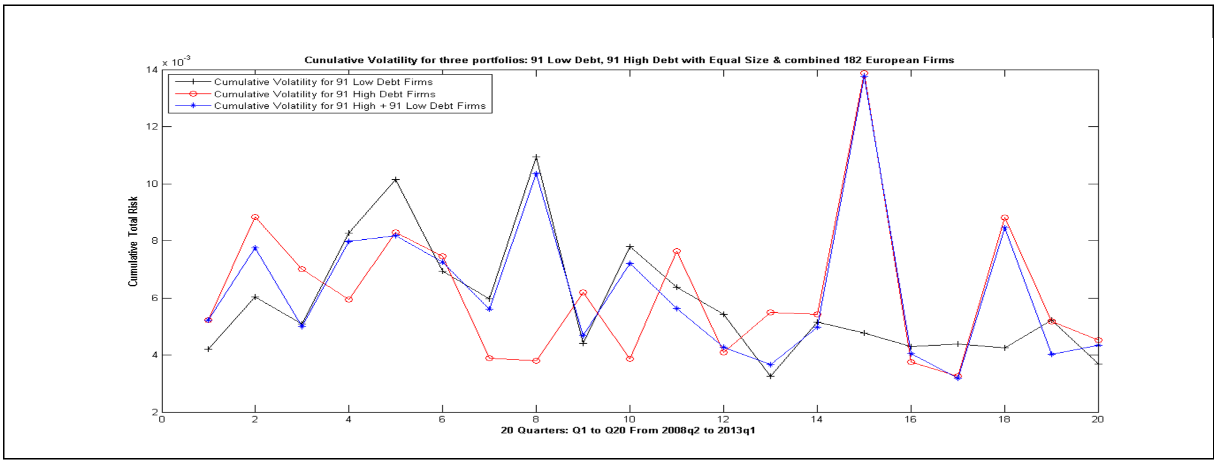

Figure 5b: Cumulative normalized sigma: 91 LD, 91 HD & combined 182 firms

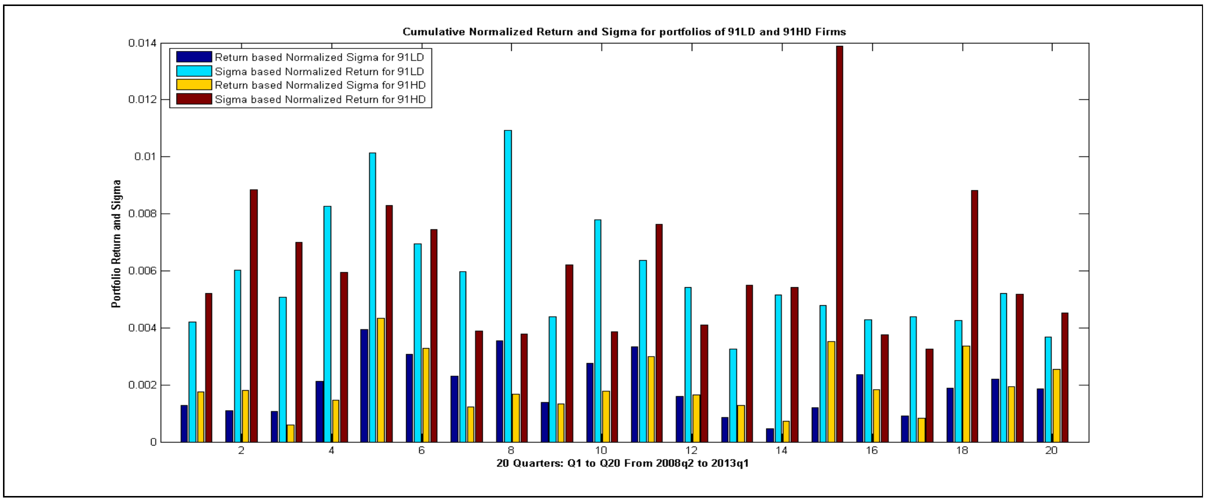

Figure 5c: Cumulative Norm. r and σ for 91HD +91 LD Firms

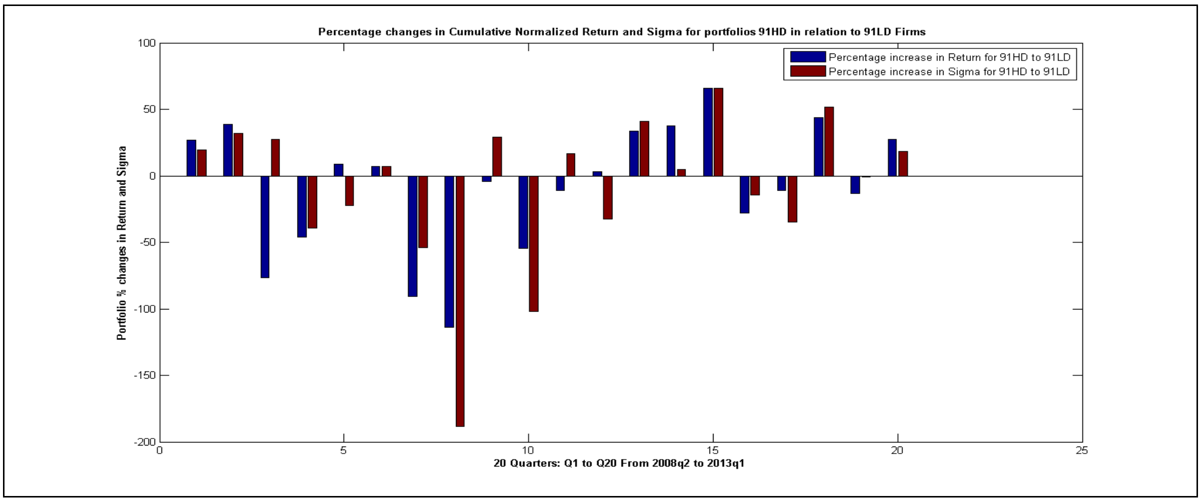

Figure 5d: Cumulative Normalized r & σ for 91HD +91 LD Firms % changes HD to LD

Notes: (1) Sum_Return_91LD = 0.0393, Sum_Return_91HD = 0.04000; (2) Sum_Sigma_91LD = 0.1166, Sum_Sigma_91HD = 0.1226.

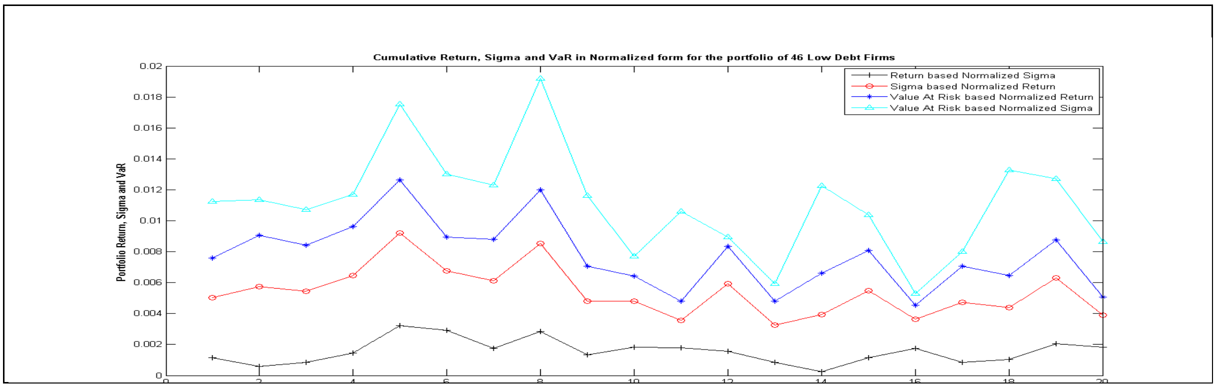

Figure 6a: **Cumulative Normalized r, σ & VaR for combined portfolio of 46LD firms**

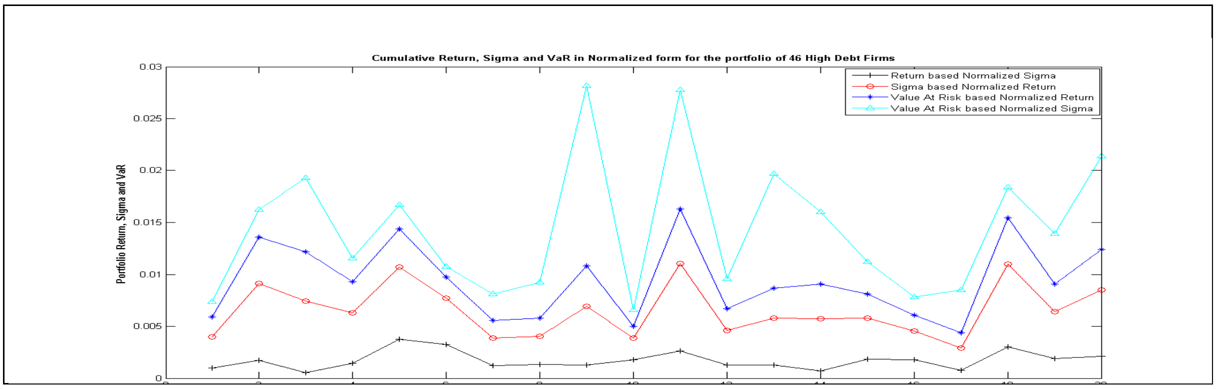

Figure 6b: Cumulative Normalized r, σ & VaR for combined portfolio of 46HD firms

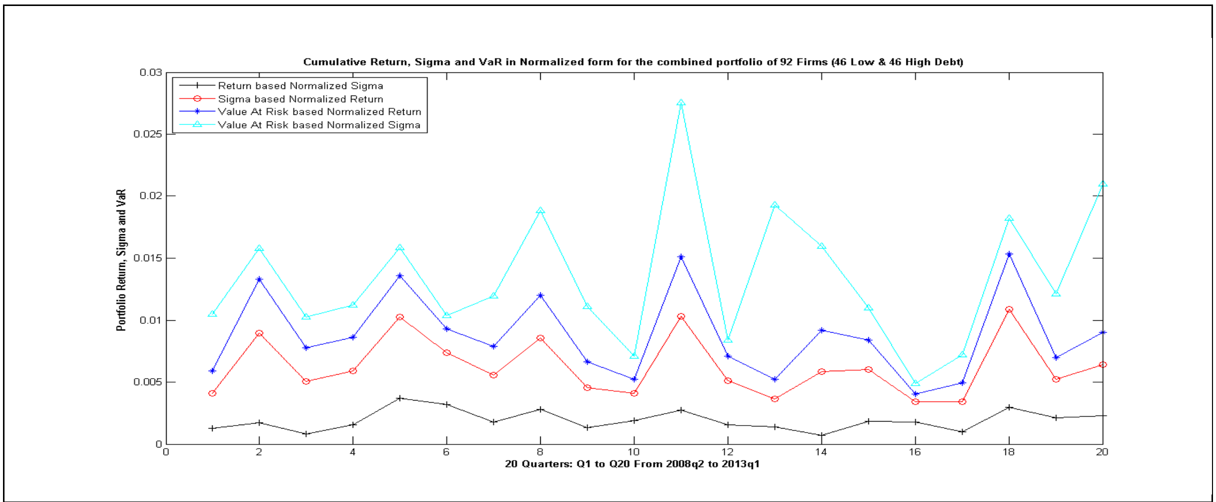

Figure 6c: Cumulative Norm. r, σ & VaR for combined port. of 92 firms (46LD+46HD)

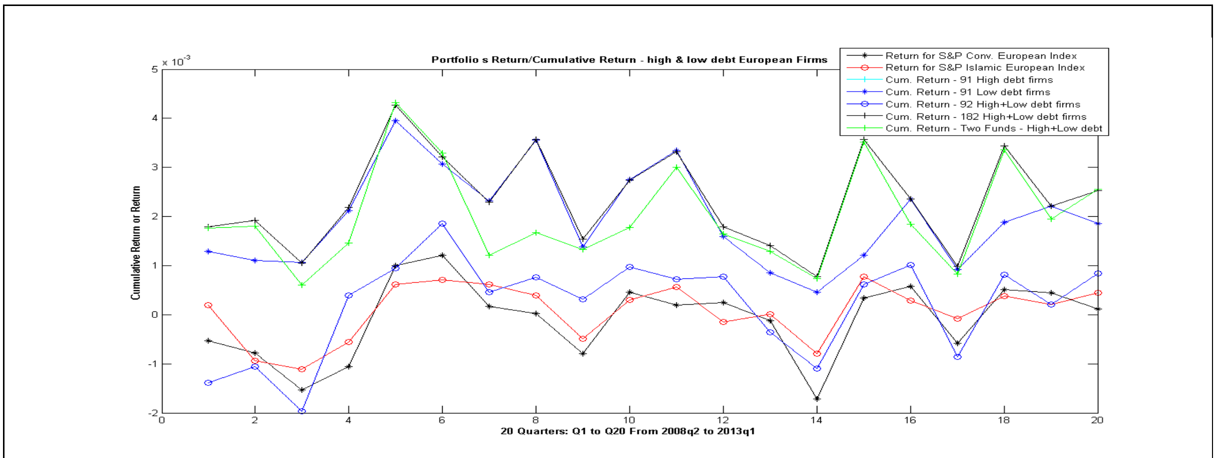

Figure 7a: Portfolio's Return/Cumulative Norm. Return: S&P, 91 HD/LD, 92 LHD, 182 LHD & 2 Funds

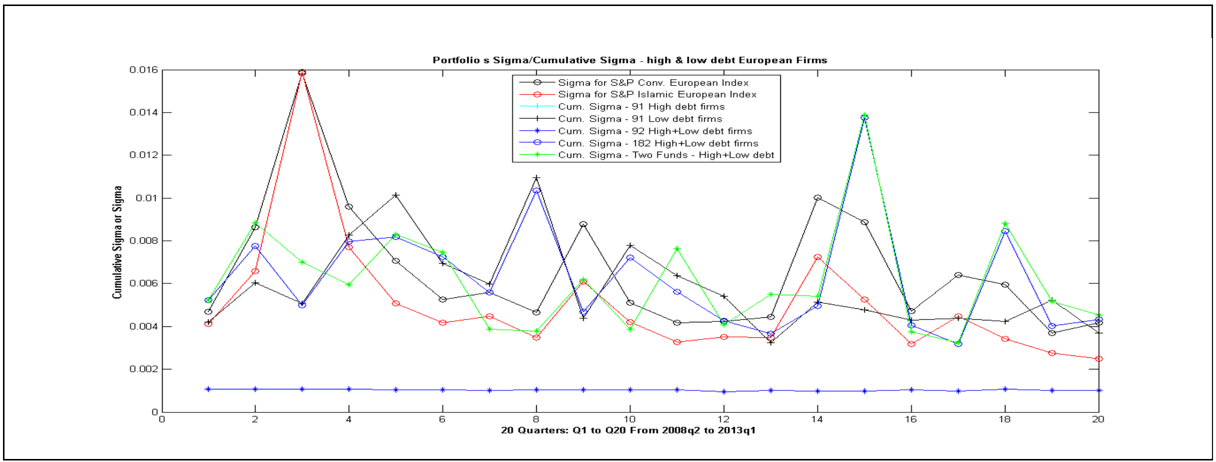

Figure 7b: Portfolio's Sigma/Cumulative Normalized Sigma: S&P, 91HD/LD, 92LHD, 182LHD & 2 Funds

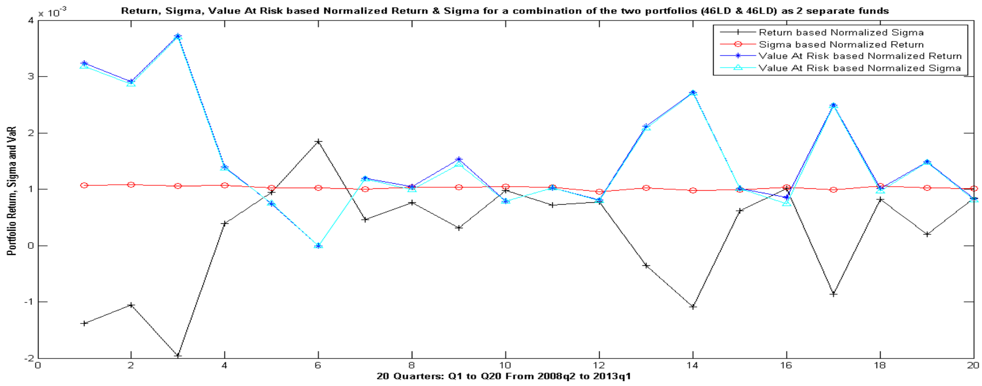

Figure 8: Cumulative Normalized Return, Sigma & VaR for a combination of the two separate funds, 46LD&HD

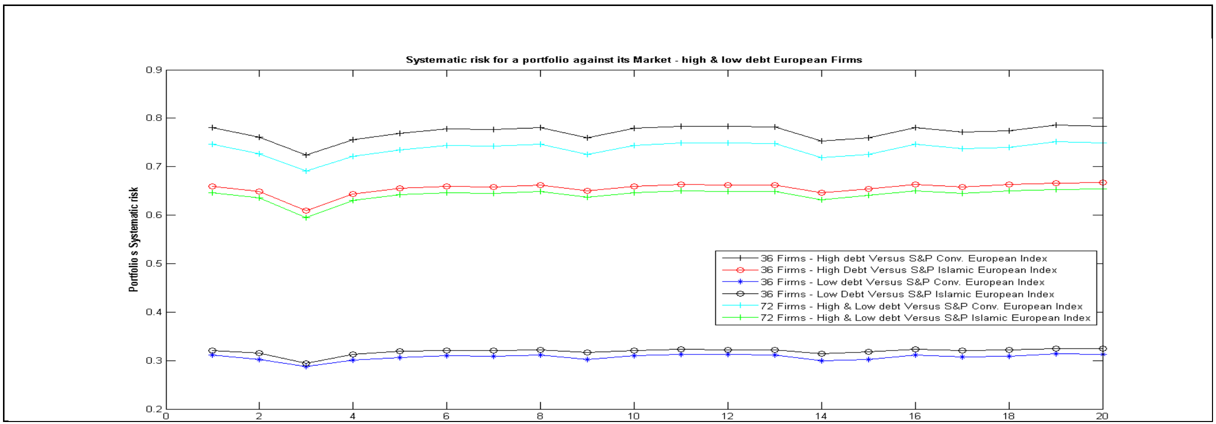

Figure 9a: β portfolios - 36 HD, 36 LD & combined 72 (High + Low) debt Firms

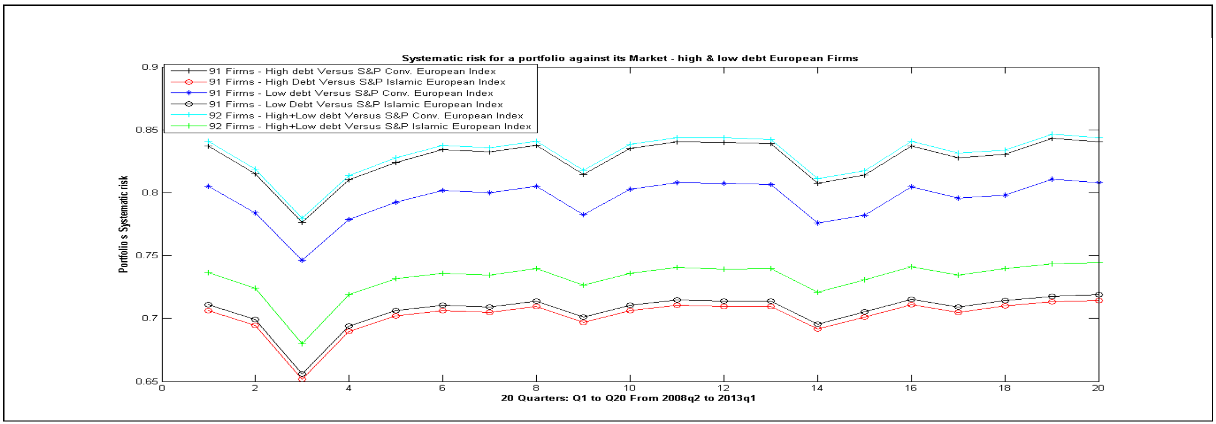

Figure 9b: β portfolios vs S&P Euro: 91 HD, 91 LD & 92 (High + Low) debt Firms

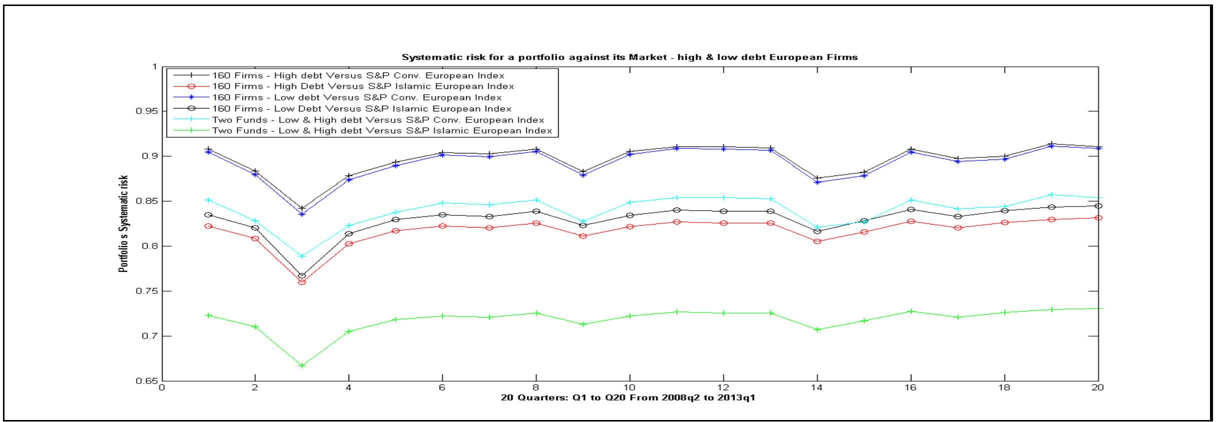

Figure 9c: β portfolios - 160 HD, 160 LD & combined two funds (High + Low) debt

Appendix

Table 1: FOC's Derivation for the Combination of LD & HD Portfolios (91 firms each)

20 Quarters	σ_1	σ_2	ρ_{12}	σ_2/σ_1	FOC's Derivative*	σ_p
2008q2	0.00105984	0.001069406	0.82129	1.009026	-4.2556E-07	0.0010602
2008q3	0.001071347	0.001072146	0.82129	1.000745	-4.1226E-07	0.0010591
2008q4	0.001081171	0.001087957	0.82129	1.006276	-4.3519E-07	0.0010602
2009q1	0.001089282	0.001113069	0.82129	1.021837	-4.8631E-07	0.0010617
2009q2	0.001062593	0.001100276	0.82129	1.035463	-5.0080E-07	0.0010610
2009q3	0.001059948	0.00109469	0.82129	1.032777	-4.9078E-07	0.0010602
2009q4	0.001033616	0.001085779	0.82129	1.050466	-5.1434E-07	0.0010599
2010q1	0.001009898	0.001082996	0.82129	1.072381	-5.4925E-07	0.0010603
2010q2	0.0010049	0.001080835	0.82129	1.075564	-5.5235E-07	0.0010600
2010q3	0.001011221	0.001086149	0.82129	1.074096	-5.5533E-07	0.0010592
2010q4	0.001010989	0.001071163	0.82129	1.059519	-5.1597E-07	0.0010581
2011q1	0.00099214	0.001079967	0.82129	1.088520	-5.7267E-07	0.0010587
2011q2	0.000987672	0.001075727	0.82129	1.089154	-5.6919E-07	0.0010589
2011q3	0.001009808	0.001089022	0.82129	1.078444	-5.6558E-07	0.00105895
2011q4	0.001018874	0.001091195	0.82129	1.070981	-5.5521E-07	0.0010595
2012q1	0.001001617	0.001089065	0.82129	1.087306	-5.8036E-07	0.0010598
2012q2	0.001012696	0.00108984	0.82129	1.076176	-5.6263E-07	0.0010604
2012q3	0.001025698	0.001084774	0.82129	1.057595	-5.2585E-07	0.0010589
2012q4	0.001042412	0.001078197	0.82129	1.034329	-4.7888E-07	0.0010584
2013q1	0.001029745	0.0010722	0.82129	1.041228	-4.8567E-07	0.00105838
*Derivative of FOC: First Order Condition						

Table 2: Maximizing SR for 2 separate funds in Unified portfolio. (46LD+46HD) & (91LD+91HD)

Combination	Two separate funds – 46LD + 46HD portfolios	Two separate funds – 91LD + 91HD portfolios

Quarter Number	20 Quarters 5 years	Maxi. Of Sharpe Ratio	Value At Risk	Weight of the Low Debt Portfolio	Weight of the Hight Debt Portfolio	Maxi. Of Sharpe Ratio	Value At Risk	Weight of the Low Debt Portfolio	Weight of the Hight Debt Portfolio
Q1	2008q2	47.035	0.00347	0.778	0.222	47.3473	0.00340	0.5251	0.4749
Q2	2008q3	46.968	0.00308	0.735	0.265	47.4222	0.00276	0.5021	0.4979
Q3	2008q4	37.670	0.00376	0.753	0.247	38.1649	0.00360	0.5175	0.4825
Q4	2009q1	15.559	0.00146	0.807	0.193	16.1895	0.00190	0.5604	0.4396
Q5	2009q2	9.637	0.00074	0.860	0.140	9.5697	0.00071	0.5972	0.4028
Q6	2009q3	5.096	0.00000	0.844	0.156	5.1675	0.00000	0.5900	0.4100
Q7	2009q4	5.394	0.00122	0.891	0.109	5.3804	0.00130	0.6369	0.3631
Q8	2010q1	5.298	0.00127	0.937	0.063	5.0010	0.00113	0.6930	0.3070
Q9	2010q2	6.158	0.00185	0.941	0.059	5.9604	0.00182	0.7010	0.2990
Q10	2010q3	6.500	0.00081	0.924	0.076	6.3890	0.00083	0.6973	0.3027
Q11	2010q4	8.586	0.00109	0.890	0.110	8.3656	0.00103	0.6603	0.3397
Q12	2011q1	9.771	0.00083	0.954	0.046	9.8091	0.00113	0.7329	0.2671
Q13	2011q2	13.774	0.00228	0.953	0.047	13.3371	0.00221	0.7344	0.2656
Q14	2011q3	14.612	0.00278	0.928	0.072	14.8864	0.00333	0.7082	0.2918
Q15	2011q4	12.093	0.00102	0.912	0.088	12.0674	0.00118	0.6895	0.3105
Q16	2012q1	9.906	0.00128	0.942	0.058	9.3679	0.00096	0.7299	0.2701
Q17	2012q2	8.436	0.00250	0.904	0.096	8.4051	0.00255	0.7025	0.2975
Q18	2012q3	4.145	0.00118	0.854	0.146	4.2206	0.00127	0.6554	0.3446
Q19	2012q4	2.962	0.00150	0.786	0.214	2.8097	0.00131	0.5942	0.4058
Q20	2013q1	2.372	0.00087	0.802	0.198	2.6202	0.00110	0.6126	0.3874

Table 3: Maximum SR, VaR & Corresponding Total Weight of LD and HD firms for Combined Portfolio of 92 firms

Quarter Number	20 Quarters 5 years	Maxi. Of Sharpe Ratio (Abs Value)	Value At Risk	Weight of the LD Firms	Weight of the HD Firms
Q1	2008q2	33.267	0.002371	0.343	0.657
Q2	2008q3	26.998	0.002922	0.345	0.655
Q3	2008q4	14.719	0.004388	0.712	0.288
Q4	2009q1	9.797	0.003179	0.615	0.385
Q5	2009q2	5.908	0.002541	0.698	0.302
Q6	2009q3	4.563	0.002294	0.622	0.378
Q7	2009q4	4.11	0.002481	0.634	0.366
Q8	2010q1	4.213	0.00199	0.32	0.68
Q9	2010q2	3.578	0.002718	0.339	0.661
Q10	2010q3	5.334	0.001876	0.187	0.813
Q11	2010q4	7.382	0.001928	0.158	0.842
Q12	2011q1	7.09	0.002331	0.325	0.675
Q13	2011q2	9.14	0.002141	0.433	0.567
Q14	2011q3	7.849	0.002922	0.075	0.925
Q15	2011q4	7.76	0.002243	0.448	0.552
Q16	2012q1	7.906	0.001583	0.376	0.624
Q17	2012q2	5.268	0.002393	0.26	0.74
Q18	2012q3	3.008	0.002188	0.207	0.793
Q19	2012q4	2.41	0.001458	0.215	0.785
Q20	2013q1	2.068	0.001949	0.334	0.666

Table 4: Cumulative Return, Sigma. VaR (based Return & Sigma) for combined portfolio of 92 firms (46 Low and 46 High Debt firms)

Quarter Number	20 Quarters 5 years	Cumulative Return	Cumulative Sigma	Cumulative VaR based Return	Cumulative VaR based Sigma
Q1	2008q2	0.00126	0.00408	0.00592	0.01046
Q2	2008q3	0.00171	0.00896	0.01330	0.01578
Q3	2008q4	0.00084	0.00505	0.00776	0.01028
Q4	2009q1	0.00156	0.00592	0.00861	0.01121
Q5	2009q2	0.00373	0.01025	0.01361	0.01585
Q6	2009q3	0.00318	0.00738	0.00929	0.01036
Q7	2009q4	0.00176	0.00554	0.00789	0.01195
Q8	2010q1	0.00280	0.00853	0.01200	0.01885
Q9	2010q2	0.00132	0.00457	0.00666	0.01109
Q10	2010q3	0.00188	0.00409	0.00524	0.00706
Q11	2010q4	0.00271	0.01032	0.01512	0.02754
Q12	2011q1	0.00158	0.00511	0.00710	0.00841
Q13	2011q2	0.00141	0.00367	0.00522	0.01932
Q14	2011q3	0.00072	0.00583	0.00916	0.01596
Q15	2011q4	0.00181	0.00599	0.00837	0.01096
Q16	2012q1	0.00180	0.00340	0.00406	0.00490
Q17	2012q2	0.00097	0.00342	0.00496	0.00720
Q18	2012q3	0.00299	0.01089	0.01534	0.01819
Q19	2012q4	0.00214	0.00523	0.00700	0.01214
Q20	2013q1	0.00228	0.00642	0.00902	0.02100

Table 5: Cumulative Return, Sigma, VaR (based Return & Sigma) - Portfolio of 46 LD firms

Quarter Number	20 Quarters 5 years	Cumulative Return	Cumulative Sigma	Maxi. Of Sharpe Ratio (Abs Value)	Value At Risk
Q1	2008q2	0.00114	0.00504	0.00761	0.01122
Q2	2008q3	0.00059	0.00575	0.00906	0.01137
Q3	2008q4	0.00084	0.00546	0.00842	0.01071
Q4	2009q1	0.00143	0.00647	0.00961	0.01170
Q5	2009q2	0.00321	0.00920	0.01266	0.01752
Q6	2009q3	0.00292	0.00677	0.00896	0.01302
Q7	2009q4	0.00176	0.00614	0.00878	0.01228
Q8	2010q1	0.00283	0.00851	0.01200	0.01918
Q9	2010q2	0.00134	0.00479	0.00707	0.01162
Q10	2010q3	0.00182	0.00482	0.00641	0.00770
Q11	2010q4	0.00178	0.00356	0.00480	0.01061
Q12	2011q1	0.00156	0.00594	0.00833	0.00894
Q13	2011q2	0.00085	0.00327	0.00482	0.00593
Q14	2011q3	0.00023	0.00394	0.00661	0.01226
Q15	2011q4	0.00115	0.00548	0.00808	0.01040
Q16	2012q1	0.00176	0.00365	0.00453	0.00528
Q17	2012q2	0.00085	0.00471	0.00705	0.00802
Q18	2012q3	0.00103	0.00439	0.00647	0.01328
Q19	2012q4	0.00205	0.00630	0.00875	0.01273
Q20	2013q1	0.00184	0.00391	0.00508	0.00866

Table 6: Cumulative Return, Sigma, VaR (based Return & Sigma) for a combination of the two portfolios (46LD & 46LD) as 2 separate funds

Quarter Number	20 Quarters 5 years	Cumulative Return	Cumulative Sigma	Cumulative VaR based Return	Cumulative VaR based Sigma
Q1	2008q2	-0.00139	0.00107	0.00324	0.00318
Q2	2008q3	-0.00106	0.00108	0.00291	0.00286
Q3	2008q4	-0.00196	0.00106	0.00372	0.00370
Q4	2009q1	0.00039	0.00107	0.00139	0.00137
Q5	2009q2	0.00095	0.00103	0.00075	0.00075
Q6	2009q3	0.00185	0.00103	0.00000	0.00000
Q7	2009q4	0.00046	0.00100	0.00119	0.00118
Q8	2010q1	0.00077	0.00104	0.00105	0.00099
Q9	2010q2	0.00031	0.00103	0.00153	0.00144
Q10	2010q3	0.00097	0.00104	0.00078	0.00079
Q11	2010q4	0.00072	0.00103	0.00103	0.00102
Q12	2011q1	0.00077	0.00096	0.00081	0.00080
Q13	2011q2	-0.00036	0.00102	0.00212	0.00209
Q14	2011q3	-0.00110	0.00098	0.00272	0.00270
Q15	2011q4	0.00061	0.00099	0.00101	0.00101
Q16	2012q1	0.00102	0.00104	0.00086	0.00074
Q17	2012q2	-0.00086	0.00099	0.00249	0.00248
Q18	2012q3	0.00081	0.00106	0.00101	0.00097
Q19	2012q4	0.00020	0.00102	0.00148	0.00148
Q20	2013q1	0.00084	0.00101	0.00083	0.00081

Table 7: Maximum Sharpe Ratio. VaR for 46 Low and 46 High Debt firms

		Low debt portfolio of 46 firms		High debt portfolio of 46 firms	
Quarter Number	**20 Quarters 5 years**	**Maxi. Of Sharpe Ratio (Abs Value)**	**Value At Risk**	**Maxi. Of Sharpe Ratio (Abs Value)**	**Value At Risk**
Q1	2008q2	21.450	0.00388	24.949	0.00330
Q2	2008q3	18.921	0.00435	19.960	0.00397
Q3	2008q4	12.272	0.00523	8.844	0.00794
Q4	2009q1	7.948	0.00405	6.025	0.00458
Q5	2009q2	5.049	0.00322	3.720	0.00433
Q6	2009q3	3.542	0.00293	3.265	0.00310
Q7	2009q4	3.134	0.00294	3.033	0.00306
Q8	2010q1	3.187	0.00279	3.860	0.00238
Q9	2010q2	2.564	0.00391	2.879	0.00382
Q10	2010q3	3.429	0.00295	4.993	0.00199
Q11	2010q4	3.936	0.00360	6.431	0.00224
Q12	2011q1	4.820	0.00308	6.032	0.00289
Q13	2011q2	7.360	0.00311	7.445	0.00257
Q14	2011q3	4.930	0.00516	7.706	0.00303
Q15	2011q4	5.828	0.00320	6.727	0.00292
Q16	2012q1	5.943	0.00239	6.102	0.00230
Q17	2012q2	3.287	0.00369	4.130	0.00319
Q18	2012q3	2.172	0.00295	2.613	0.00255
Q19	2012q4	1.544	0.00242	2.060	0.00187
Q20	2013q1	1.434	0.00264	1.671	0.00234